Architectural Hardwood Finishing

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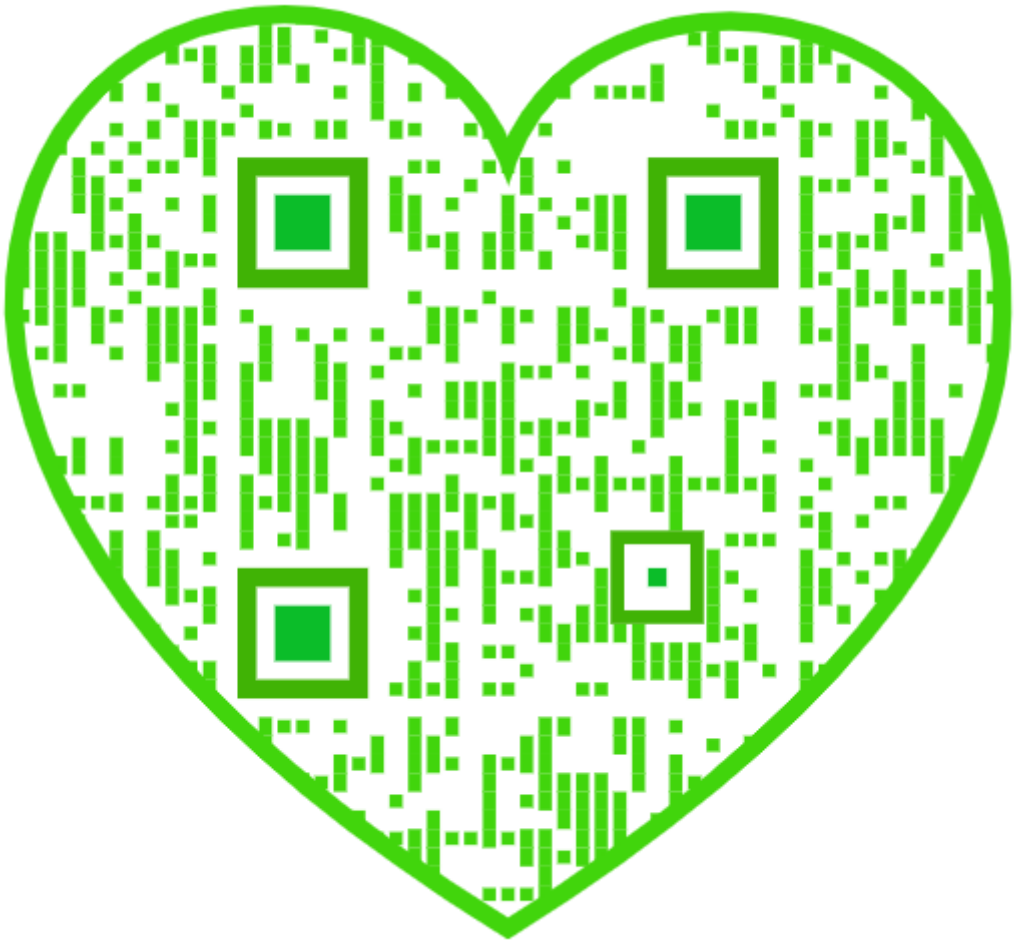

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Architectural Hardwood Finishing

A Practical Treatise on Modern Methods of Finishing the Wood Work of New Buildings

by George Whigelt

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CHAPTER VIII.
Varnishing.
page fifty-one.

CHAPTER IX.
Rubbing and Polishing.
page sixty.

CHAPTER X.
Wax Finishing.
page sixty-eight.

CHAPTER XI.
Floor Finishing.
page seventy-three.

CHAPTER XII.
Finishing of Fireproofed Wood.
page seventy-seven.

CHAPTER XIII.
Refinishing.
page eighty-three.

CHAPTER XIV.
Piano Finishing.
page ninety-seven.

CHAPTER XV.
Best Methods of Using Water Stains.
page one hundred and three.

PREFACE.

The series of articles which is here republished in book form was printed in the twelve issues of The Painters Magazine for 1905. They were written by a practical mechanic, who has had more than twenty years' experience in all classes of hardwood finishing and who has invented a number of valuable materials and processes. Two articles on kindred subjects, Piano Finishing and Best Methods of Using Water Stains, which also appeared in The Painters Magazine, have been added to make the work more complete. The publishers trust that this book may prove an acceptable addition to the library of the practical painter, the architect and every one interested in architectural hardwood finishing.

New York, January, 1906.

MODERN methods of wood finishing in new buildings will be described in this book, the subject being treated from the standpoint of the practical wood finisher engaged in all grades of work in modern buildings. At the risk of telling something already known to the experienced wood finisher, every branch of the work will be thoroughly described in all its details, in order to make the entire subject of hardwood finishing perfectly plain to even the most inexperienced finisher. We must also remember the necessity of every one connected with the painting business of knowing the proper treatment of hardwood. The wants of even the most experienced finisher will not be forgotten, and many suggestions will be given to practical painters for up-to-date work and all the new methods will be described with which the writer has become acquainted in twenty years' experience in that line.

CHAPTER I.

Woods Used.

THE woods most commonly used at present for the trim and floors of buildings which require a natural finish are oak, ash, walnut, mahogany,, birch, cherry, maple, redwood, cypress, sycamore, pine, whitewood, rosewood, and a number of others.

They are divided again into hard and soft woods,—open pored and close grained woods,—and each of them require a different preparation and finish to suit the taste and style and to conform with the nature of the wood. Each kind of wood has its own natural beauty and the main object of the finisher should be not only to make a superb finish and to preserve the wood, but to improve and develop its natural grain and beauty. The most expensive wood will look cheap if not finished properly and a more common wood will look beautiful if rightly treated.

Oak is classified first by the manner in which the boards are sawed into straight and cross-cut, or quartered oak and again into white, red and dark oak.

Ash is generally of but one grade and is often used for framing oak panels, as it is less expensive than the former, except the Hungarian ash, a beautiful variety.

Walnut has a number of grades and nearly every climatic condition produces its own and peculiar species, some being of very great value. We have the straight American walnut, the French walnut, used for panels and cut from the root of the tree; also the South Russian or curly walnut, which is a softer kind, but very rare and expensive.

Mahogany is obtained in endless varieties, including prima vera or white mahogany. Much of the wood sold as mahogany is cut in the United States, but the more valuable kinds come from San Domingo, Central and South America.

Birch is divided into straight and curly, and, like cherry, is an American wood.

Maple is known for its whiteness and hardness, and is generally used for floors, with the exception of the bird's-eye maple, which is used for paneling and requires great care in finishing.

Redwood, especially that coming from California, is a wood resembling mahogany in many of its characteristics.

Sycamore is exceptionally hard, and the cross-cut or quartered produces wonderfully beautiful effects.

Cypress is in a class by itself. It is related to the cedar, very tough and durable, and, on account of its long fibers, it is very troublesome for the finisher.

Rosewood has been abandoned on account of its scarcity. Its oily nature has made it difficult for the best finisher using the best material to produce perfectly satisfactory results.

Whitewood, or poplar, is not often finished in natural, and curly poplar has been very seldom used because its value is overlooked.

Pine has received the greatest attention and is used in endless varieties and for almost all possible and impossible purposes. It is divided into hard and soft, white and yellow, straight and curly pine.

White pine of good quality has become very scarce and is now more expensive than oak, but is largely used for doors.

Yellow pine serves for all purposes and the Georgia variety is largely used for floors. North Carolina pine is of a curly nature and produces very good results in the hands of the experienced finisher.

CHAPTER II.

Sandpapering, Scraping and Preparing the Wood.

ALTHOUGH the most essential point in producing a good finish, sandpapering, scraping and preparing the wood is generally overlooked, but it is of the utmost importance and cannot be too carefully done. Only a perfectly smooth surface can retain a good lasting effect and such a surface will lessen the work more than a good many will admit. An uneven surface showing plane marks must be scraped, which can be done with a number of different tools, of which the plain scraper is always the best. It consists of a piece of hardened steel about 2 by 5 inches in size, the long edges of which are evenly ground. Considerable experience is required in sharpening, which is done by pressing a round piece of steel against the edges, slightly bending them over to form a cutting angle. This round piece of steel is drawn along the edge until the proper effect is produced. Resharpening is generally done with a good steel file, but is better done on a flat oil stone. Other scrapers in all different shapes are used to suit the needed require-

ments. Their quality may be determined by the length of time they will last without resharpening.

Sandpapering.

Common sense, skill and experience will tell the finisher what grade of fineness in sandpaper is required to do the work. Always be careful to rub with gentle pressure lengthwise, or with the grain of the wood. A suitable block, made of cork or wood, should always be used, and in moldings the block must be cut to fit the hollows. The sandpaper is wrapped around the block and when worn off is turned around or exchanged. Sandpaper should never be torn off the sheet, but cut into parts by placing the sandpaper, rough side down, on a table or board and cutting or ripping the inside with a knife, after which it is bent in a sharp angle and pulled apart. To test the quality of sandpaper bend it sharply and see if it parts, that is, if the coarse part of it will separate from the paper. Use will tell you the difference between good and bad sandpaper surely and quickly. Care should be taken in sandpapering not to round the edges in panel work.

Steel Wool.

The use of steel wool and steel shavings for smoothing purposes in this country is somewhat new and for

quickness and accurate work it cannot be classed with sandpaper, although it is in itself more expensive than the latter. Its discovery, as a material for rubbing down, was left to the father of the writer, who, about the year 1882, procured some steel shavings, a waste material at that time, from a tool factory, and used it for rubbing down floors, Since that time it has been manufactured in a number of different grades, from coarse to fine, arranged

FIG. 1

FIG. 2

the same as sandpaper and used for the same purpose. It is advisable to protect the hands with leather gloves to prevent splinters of steel wool from entering the hands. Steel wool will prevent the rubbing off and rounding of fine edges and is the only material which can successfully be used in carvings.

The quality of steel wool is shown by its elasticity and brittleness, the more elastic the better, also by its cut. The best grade of steel wool is cut with a triangular section (see Figure 1.); the common grade is cut in the segment of a circle (see Figure 2.)

For rubbing down very stringy, or very hard wood, steel wool cannot be compared with any other material.

Pumice Stone and Soft Sandstone.

Pumice and sandstone are sometimes used for rubbing straight surfaces and in block form are better than sandpaper for that purpose. In powder form they are used with water or oil for rubbing down varnishes.

CHAPTER III.

Stains and Staining Woods.

WE now come to staining the wood and the materials used for that purpose. Staining is so variable in itself and it is necessary besides to satisfy the tastes of your customer and the sometimes impossible ideas of the architects, that it requires a most skillful and experienced mechanic to make not only a sightly but also a tasteful and harmonious job. Thorough knowledge of both work and material is required from the finisher.

Stains are divided into numerous varieties, as follows: Water, spirit or alcohol, acid and alkali, oil and varnish, and these again into pigment, lake, aniline and vegetable stains. There are also methods of staining or darkening by steaming, fuming, etc., including the darkening of the wood caused by fireproofing the wood, which is frequently done, and which requires a special treatment which will be described later on.

Water stains are commonly mixtures of lakes or vegetable matters and anilines.

Lakes, or vegetable stains, are decoctions of natural colored woods, such as logwood, Brazil wood, sandal wood, Sapan wood, Lima wood, canewood, Campeachy wood, etc., roots, leaves, fruits, skins, bark and numerous other vegetable matter are also used in their manufacture. Water stains are most lasting, if made from vegetable matter. They also give the most natural looking colors, and they should be applied as warm as possibly can be done, but never at a temperature lower than 100 deg. Fahrenheit.

Water stains, mixed with anilines, are very often used on account of their cheapness and quick preparation, but they are not as lasting in color. They fade quickly, especially if exposed to the sunlight and show streaky and botchy if not properly applied.

Spirit Stains.

Spirit or alcohol stains are made the same way as water stains, and are used to obtain a more penetrative stain, also a greater density of color and to allow a quicker job, as alcohol evaporates more quickly, and when shellacking is resorted to afterward they allow an almost immediate application of the same. Otherwise a water stain is just as effective.

To prevent the raising of the fiber of the wood in applying either the wa-

ter or alcohol stain, a good many wood finishers add a small portion of glycerin or castor oil, but the utmost precaution in using those articles is advised, because a too liberal use of the same will prove disastrous to the after finish, as both of them are of an oily, non-drying nature, causing the shellac or varnish to scale or chip off; preventing also the penetration of the stain into the wood and having a good many other disadvantages.

White pine, whitewood, cypress and a few other very spongy woods are debarred from water or alcohol staining, except when a so-called solid color is required, because the application of stain on those woods cannot be evenly done, as their soft and spongy nature will absorb the stain immediately, and the touching of the same place a second time will show a decided mark or lap. A dipping process would be about the only way to partially overcome those disadvantages.

The application of both water and alcohol stain should be done with a brush, the bristles of which are set in cement, a sponge or swab, but no doubt the brush is the proper tool. All stain which is not at once absorbed by the wood should be wiped off with a soft rag. For dipping, a vat or barrel should be used or any other vessel

which does not contain any metal parts whatever, but which is entirely made from wood.

All stained wood should be given the proper time to dry, and should receive two coats of stain, the second coat should be applied after the first is properly dried out, or if a quicker and cheaper job is required a coat of shellac or copal varnish should be given before sandpapering, excepting only where the wood is to be filled with wood filler before finishing up. The reason for applying a second coat is simply that after sandpapering, after the first coat, small light dots will appear wherever the stain has not penetrated deep enough into the raised fibers.

Mordants.

By mordants we understand a chemical to fix or set a color to prevent it from changing. For the finisher, alum and ferro-sulphide, known as green copperas, are sufficient. They are used by dissolving a quantity, about one-half pound to a gallon of warm water, and applying a coat over the work before sandpapering or varnishing.

Acid and Alkali Stains.

Staining with acid or alkali stains is done practically the same way as has

been described for water and alcohol stains, with the exception that these stains generally do not require a second application. Care must be used in handling these stains, as most of them are very dangerous poisons. The most commonly used materials for these stains are chromate and bichromate of potassium, ferro-sulphide or green copperas, picric and sulphuric acid, iodine, alum, vinegar, soda, caustic soda, potash or pearl ash, ammonia, lime, etc.

Chromate and bichromate of potassium are generally used to produce a so-called golden oak effect on oak, or an antique mahogany effect on mahogany. Picric acid will always give a yellow effect and is used to lighten up, in fact to entirely change the color, of walnut. Copperas is used to set and deepen the obtained colors, and alum and vinegar to neutralize or kill the after effects of acid and alkali stains. Iodine produces a very beautiful brown stain, but is rather too expensive to be used commonly. Caustic soda and kindred materials produce dark stains, but on account of their after effects are not often used. Lime will produce a similar effect, but not so deep a color as soda or potash, and is used by slaking the same as in a sufficient quantity of water to make lime milk, which is brushed over the sur-

face to be stained, and allowed to remain to dry, after which it is brushed off, washed clean and the surface is then coated with vinegar.

Ammonia is used the same as all other alkali stains, by reducing it with water to the required strength, and is applied with a grass or fiber brush, as it will destroy any hair or bristle brush.

Acid and alkali staining is done only on wood containing tannic acid in a larger or smaller percentage, as those stains will hardly produce any coloring on any dry, pitchy, or sappy wood.

Fuming.

Fuming of wood is a procedure which is not often resorted to for various reasons, but which has a decided advantage over all other methods, because it does not raise the fiber of the wood, leaves it in its original condition, but produces only color which, of course, can be secured in different shadings from light to dark. It is the only method to produce a so-called Flemish oak effect, and should be done in all cases where a wax finish is required, leaving the wood in its normal state. As a rule, oak is the only wood subjected to fuming, but other woods can be done the same way. Fuming is done in a simple way, as follows:

Take an air-tight box or room, place several flat porcelain or glass dishes on the floor containing 26 deg. ammonia. After placing the wood to be stained on brackets, close the room or box up tight, and allow the wood to remain twelve hours or more until such a time as the desired effect is obtained, after which give it a good airing to allow the ammonia gases which remain in the wood to evaporate before finishing up. The result is a perfect, even staining, without the need of sandpapering.

Oil and Varnish Stains.

Oil stains are not often used by the finisher, as they do not always give the proper result. For very soft and spongy woods, as white pine, whitewood, cypress, etc., they are essential, but on very hard woods they refuse to penetrate deep enough into the wood and with very few exceptions all oil stains will darken and quite often they will cause the varnish to shrink if no shellac is used before varnishing. Furthermore, a good many oil stains, especially when made with ordinary colors, will mar and cloud the grain of the wood, on account of their opacity. The materials used for oil stains are linseed oil, japan, benzine, turpentine, asphaltum, Van Dyke brown and all lake and oil colors. The finer the color

the more brilliant will be the effect. Asphaltum and Van Dyke brown are mainly used to obtain the golden oak and antique effects in oak and mahogany, but have otherwise various uses.

For drying purposes in mixing oil stains the borate of manganese is always preferable to japan driers, except when asphaltum is used. Anilines are not soluble in oil and the articles which are sold as oil-soluble anilines are nothing but aniline dissolved in glycerin or other fatty and non-drying ingredients, and are worthless for the wood finisher. This is a fact which the writer, after years of experimenting, has found out to his cost.

Varnish stains are household articles and are not used by the artisan except when on old work a toning up is requested. In applying varnish stains the same care is required as in enameling, as they set quickly and will show laps if repeatedly worked over.

Paraffine and all non-drying and mineral oils should not be used in staining wood or for any other purpose, except rubbing down.

CHAPTER IV.

The Preparation of Stains.

PREPARING or making stains is an important point in the work of wood-finishing, and also a very interesting item owing to its many variations. This work should usually be left to the manufacturer of finishing materials, but in many cases the finisher is required to compound his own stains to suit the taste and requirements of the customer or architect.

The time, of course, is past where the artisan went out to gather his own raw materials in the shape of barks, leaves, roots, fruits, fruit skins, etc., and the best he can do now is to buy the finished products, or, at least, the materials ready to be dissolved in the respective solvent.

In the following will be given a few of the most commonly used stains and how to prepare them, considering an effective material, easy to use, and which may be cheaply prepared.

Antique Effect for Oak and Other Woods.

1. Boil together 1 oz. catechu with 1½ pints of water, apply and follow

afterwards with a coat of 1 oz. bichromate of potassium dissolved in 1½ pints of water. The result will be a golden oak effect on oak. The same used on mahogany will produce a dark antique.

2. Coffee, ground and roasted very dark, boiled with water, will produce a beautiful dark brown on oak or other light woods.

3. Green walnut peels boiled with water will produce a deep brown, and if applied several times will turn black, especially when followed by a coat of iron filings soaked in vinegar for several days or a coat of ferro-sulphite (green copperas) dissolved in the proportion of about ½ pound to a gallon of water.

4. Fresh slaked lime, called milk of lime, whitewash, applied with a grass or fiber brush and brushed off after drying will give an antique or dark-brown effect on all woods containing tannic acid, such as oak, mahogany, ash, birch, cherry, walnut, etc.

5. A similar effect is obtained by the application of liquid ammonia (hartshorn), on the same kinds of wood, for oak, especially to produce the old English color.

6. For a XVI. century effect on oak, apply sulphuric acid diluted with equal parts of water.

7. Black asphaltum varnish mixed with Van Dyke brown and thinned with benzine or turpentine will also give a golden oak effect on oak and a nice dark brown color on light woods.

8. Bichromate or permanganate of potassium will produce a similar effect on oak and mahogany to that described in No. 1.

9. One gallon of strong vinegar, or dilute acetic acid mixed with ½-pound Van Dyke brown, 1 pound of burnt Turkey umber and ¼-pound of rose pink, C. P., prepared at least 24 hours before using, will produce a deep rich brown color on any kind of wood.

11. Bismarck brown added to burnt sienna and dissolved in alcohol can be used in preparing stains for birch, cherry, or other light-colored woods for a mahogany color, or can also be used on mahogany itself to enrich the color of it. By adding burnt Turkey umber the color will be proportionately darkened.

12. Anilin colors, of desired shades, can be mixed with alcohol for any kind of wood, and if the raising of the fiber is objectionable the addition of a small quantity of castor oil or glycerin is recommended, if carefully used.

13. Anilin colors, as above, boiled with water and a small quantity of

soda or potash, are also used for the same purpose, but such color will show different effects than if mixed with alcohol, and, besides, all anilin colors will fade and change within a short time despite protection by varnish. The use of a mordant for those colors is required, and is applied afterward in the form of alum, 1 pound dissolved in warm water, or green copperas as previously mentioned. In using this mordant the stain has to be thoroughly dried.

13. A green stain on all kinds of woods is made by dissolving verdigris in soft water or vinegar.

14. Chemically pure colors and lakes, selected according to requirements, and boiled with soft water and a small amount of gelatine or isinglass will produce very good results and are very permanent.

15. The same as above, mixed with alcohol and a small quantity of shellac varnish will be nearly as satisfactory.

16. Another process of staining is by using picric acid dissolved in water or vinegar. This will lighten walnut considerably and give a yellow color to other woods, with the exception of mahogany.

17. Bichromate of potassium, dissolved in water, applied on walnut,

will make a good imitation of rosewood.

18. To imitate walnut on pine lumber use a solution of black privet berry in liquid ammonia, about 2 oz. to 1½ pints.

19. A metallic black stain on any kind of wood may be had by applying a strong solution of nitrate of silver under exposure to light.

20. All direct color, such as ivory or drop black, ochers, umbers, siennas, can be used to make water, alcohol or oil stains, similar to those described in former items.

21. Logwood chips boiled in soft water or logwood extract dissolved in alcohol are used to make dark brown or soft black stains, if followed up with a coat of copperas solution or iron filings in vinegar.

22. Varnish stains for use in touching up old work, otherwise known as household articles, are made by mixing good transparent lake or mineral colors with japan and adding the desired quantity to a good copal varnish gradually, under continuous stirring.

Numerous other methods could be mentioned, but the foregoing will be found the most essential ones in architectural work, and the desired effects have to be ascertained by experimenting on the part of the finisher.

CHAPTER V.

Wood Fillers.

ALTHOUGH a necessity in modern wood finishing, the use of wood fillers dates back only some thirty to thirty-five years. Nowadays a good many articles are manufactured and sold under the name of wood fillers which are good for anything else but the purpose they are intended for. Wood fillers are used not only to fill the pores of the wood, but have to serve also for a good many other purposes, in fact the proper filling of open grained wood with proper material is most essential for the high grade finish of the wood.

The general make up of a filler should be of a hard transparent base, to prevent clouding the grain of the wood. Furthermore, it should consist of a good binder in the form of a drier, a varnish and oil and also of a thinner.

Competition has brought the price of wood fillers to such a low level that even the large consumers, who are using wood filiers by the ton lots, do not attempt to make them themselves, but buy the ready-made article, therefore it does not pay the smaller user or finisher to make wood filler in small quantities; first, on account of the lack of proper material and lack of ma-

chinery to produce a uniform mixture.

Clays, chalk, terra alba, whiting, barytes, talcum, asbestine, marble dust, corn starch and all opaque materials or those of a soft or easy decaying nature must be left out entirely in the making of a good filler, and only materials of a certain hardness and transparency should be used. In buying wood filler it would be of advantage to use the following test.

Test for Wood Fillers.

Take a piece of light colored cardboard or heavy paper, or still better, a piece of raw, unfinished wood; then

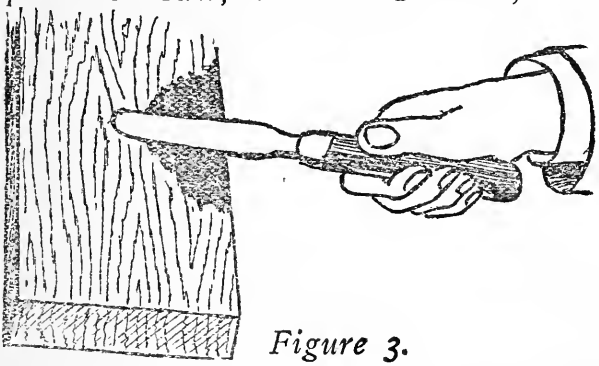

Figure 3.

take a small quantity of the pigment or sediment in the filler and place the same on the board. Take a clean steel knife, and by gently rubbing the same over the filler in the same manner as if polishing the knife (see Figure 3), the filler should turn black, which will prove the presence of a hard crystal.

The sooner the filler turns black the better the quality will be. In comparing two or more different grades of fillers, you will probably find the difference. Should no change in color appear, that is, should the filler fail to turn black, you may safely reject it as an unfit material for hardwood finishing.

Properties of Fillers.

Ground glass or the well known silex or silica are best known, the former being seldom used because the latter is sold at such a low figure that it can be used with advantage in the cheapest grades of fillers, besides it appears so abundantly that there is no fear of its becoming exhausted; in fact one-third of our planet is composed of silex or quartz. It even enters into vegetable matter in the form of coatings, such as cane. Silex is found in several forms: one is the natural deposit of fine silex, which is lacking the hardness and the crystalline form and is valueless in the manufacture of filler; another form is crystal quartz, which is used for a good many purposes, especially in the manufacture of glass, polishing materials and scouring soaps; and, last but not least, in the manufacture of wood fillers. In its natural state quartz appears in the form of large rocks, either in a

milkish white or slightly colored hue of all colors of the rainbow or in a dirty brownish black called smoky quartz. It is chipped, broken into small pieces by heating the same in a kiln and suddenly cooling it by drenching the same with cold water, by which process it also becomes harder. Then it is assorted according to color, reduced to still smaller pieces and finally ground into a very fine powder which is of such fineness that the aid of a magnifying glass of 3,000 strength will be necessary to detect the single parts, every one of which will show the form of splinter or small needle. The hardness of quartz or silex is 7, which is only three removed from the diamond, which is 10. Silex in powdered form looks perfectly white and becomes transparent by mixing the same with oily substances. Silex is non-absorbent, which is another beneficial feature for its usefulness in the manufacture of wood filler. The hardness and sharpness of the single parts of silex guarantee the perfect filling of the pores of the wood, and at the same time act as a cleaner or polisher of harder grains, bringing out the beauty of the wood not only in its natural clearness, but also developing and improving its general appearance. Wood not filled with pure silex filler will always show a cloudy effect and can be easily detected from the former.

Colored Wood Fillers.

Wood filler is generally colored or should be so if used on the darker kinds of wood or where a certain effect is required on light colored woods or when a filler is used on stained wood. In the latter case it is only required to match the color of the stain, while in the first case a colored filler is used to produce a colored or stained effect on the wood.

When colored fillers are used on open pored and hard grained, so-called quartered or cross-cut woods, mainly on oak, ash, curly yellow pine, etc., it produces beautiful effects, and the perfect wood finisher can show his ability in producing effects of peculiar results, entirely different from the artificial stained wood.

In the following will be given some formulas for coloring or staining wood fillers.

Colored Wood Fillers.

1. Antique Oak:—Take 10 lbs. of paste filler and add ¼ to ½ lb. of burnt Turkey umber.

2. Golden Oak:—10 lbs. of paste filler. ¼ lb. of Vandyke brown, ½ to 1 pint of black asphaltum varnish.

3. Dark Golden Oak:—10 lbs. paste filler, ¼ lb. Vandyke brown, ¼ lb. burnt Turkey umber, ½ ounce drop black, ½ pint black asphaltum varnish.

4. Flemish Oak:—10 lbs. paste filler, ¼ lb. Vandyke brown, ¼ lb. burnt Turkey umber, 1 ounce drop black.

5. Dark Effect on Oak or Ash, with a Greenish Cast:—10 lbs. paste filler, 1 to 2 ounces of lamp black.

6. Forest Green:—10 lbs. paste filler, 1 ounce of lamp black, ¼ lb. of chrome yellow, or if a deeper moss green is required, take ½ lb. of light yellow ocher instead of chrome yellow.

7. Mahogany:—10 lbs. of paste filler, ¼ to ½ lb. of burnt Italian sienna.

8. Bright Mahogany:—10 lbs. of paste filler, ¼ to ½ lbs. of burnt Italian sienna, 2 ounces of rose pink or rose lake or maroon lake.

9. Antique Mahogany:—10 lbs. of paste filler, ¼ to ½ lb. of burnt Italian sienna, ¼ lb. of Vandyke brown.

10. Very Dark Antique Mahogany:—10 lbs. of paste filler, ¼ lb. burnt Italian sienna, 2 ounces of rose pink or lake, ½ ounce of drop black.

11. Rosewood:—Same as No. 10.

12. Walnut:—Same as Nos. 1, 3 and 4.

13. Ebony:—10 lbs. paste filler, ¼ lb. drop black, ½ ounce Prussian blue.

All other woods will show a similar coloring if the respective colored filler is used on them, and in cases where those woods have been previously stained a very good imitation of the genuine wood is produced, which is true in the case of using ash for oak and birch or cherry in imitation of mahogany.

Liquid fillers can be similarly colored, but care must be taken to use only the purest and strongest kinds of stainers and colors.

CHAPTER VI.

Paste Fillers and How to Use Them.

AFTER describing the various wood fillers and materials used for this purpose in the last chapter in a general way, it may be here stated that fillers ordinarily are divided into paste and liquid fillers. The paste fillers are really fillers used for filling the pores of the wood, while the liquid fillers belong to the class of primers or first coaters.

Paste fillers must be thinned down to the consistency of flowing varnish. As a thinner you may use turpentine or benzine, but the turpentine is much to be preferred for the reason that it is low volatile, or evaporates slower, and is therefore less inflammable and dangerous. Turpentine holds its moisture for a considerably longer period than benzine and thereby allows the finisher a better chance to apply the filler on a larger surface and to rub it into the pores more properly than filler thinned with benzine. Where a paste filler sets too quick, that is, gets hard before the finisher has a chance to rub it in, it is advisable to add a small quantity of boiled linseed oil which, if used in excess, will retard the drying. A short, heavy brush should be used to apply the filler and the material must be thor-

oughly worked crossways so as to rub into the pores as much filler as possible. This will make the after work easier. The finishers, as a general rule, apply the filler in a very easy manner, simply trying to get it on the surface and relying entirely on the rubbing in, which is a wrong idea. After the filler is applied it should be allowed to set; that is, sufficient time should be given to let part of the turpentine evaporate until the surface appears "flat," and then it must be thoroughly rubbed crossways into the pores. This process is called packing, and requires some experience. The packing or rubbing, in itself, is done with a piece of bagging or some similar kind of coarse cloth. A good many finishers use excelsior or shavings, but those articles are not as practical, as they are liable to pull out part of the filler again, especially in the hands of an inexperienced person. After assuring yourself that the pores have been properly filled, the work must be slightly wiped off with a piece of soft cloth, to remove any traces of filler, which probably may have been left by the use of the coarse cloth being filled up with an excess of the material. If at any time the filler has set too hard; that is, if it is partly dried up so as to make the rubbing in impossible or difficult, a small amount of turpentine

placed on the rubbing cloth, or still better, a brushing over the surface with turpentine, will remedy the trouble.

Before the next coatings are applied, from twenty-four to forty-eight hours must be allowed for drying. Some finishers make a great mistake in hurrying the work just after filling, believing no harm is done, whereas in fact the most harm to the final finish had been done. Proper filling lightens the work in after finishing considerably, therefore some finishers believe in applying two coats of paste filler with good results. The second coat of filler is applied and treated the same as the first coat, a slight sandpapering between coats being beneficial. A second coat of paste filler is, of course, only necessary on very coarse grained or open pored woods, such as ash, oak, certain kinds of mahogany, walnut, etc. For filling small moldings and carvings, properly speaking for cleaning the filler out of them, a few plain tools are required.

In the first place a pointed wooden pick, easily made from any kind of a piece of hard wood, is used in cleaning the remaining filler out of the corners and crevices. Iron or other metal tools must not be used, as those will leave black streaks, providing a good pure silex paste filler has been used. Neither

should steel wool be used instead of sandpaper for smoothing down. It is best to use a small wooden hand brush, with or without handle, shaped like a small scrubbing brush, which may be made of tampico, but a better grade of stiff bristle brush, of the same shape, is much to be preferred, being more durable and practical. This brush is used for cleaning carvings and deeper laying parts of the work where it is impossible to apply the cloth.

There is little more to be said about the use of paste fillers, as the finisher has to find out the fine points of this class of work by continual practical experience. The filling of close grained wood with paste filler has been often discussed and laughed at by a good many, but it is done very frequently and some beautiful effects are produced with colored fillers on so-called burly or curly woods. North Carolina curly pine, treated with a colored paste filler, will produce such varieties of effects that it is at times impossible to detect the original.

CHAPTER VII.

First Coaters.

TO the list of first coaters— or primers — belong the liquid fillers, as well as the shellacs and their substitutes, which will be described in the following chapter, but owing to the large variety of those articles, only the most common will be mentioned, and as every manufacturer has his own individual material, the omission of some of them may be excused.

Liquid Fillers.

As mentioned previously, liquid fillers belong to the class of first coaters or surfacers, because they are not fillers in the proper sense of the word, but are used to stop the suction of the wood and to form an underground or base for the subsequent coatings. Liquid fillers are not rubbed into the pores of the wood, but simply brushed over the surface in a somewhat similar manner to varnish. It is not recommended to use colored liquid fillers, because it is a peculiarity of silex and other material used as a base for liquid filler, that the smallest addition of color will make them very opaque and transform them into a paint-like substance, with the result of covering

the natural grain of the wood and clouding the general appearance.

A great humbug and fake business is frequently done under the name of liquid fillers. Many cases are known where painters or finishers who are under contract to use a liquid filler on a given job go to work and buy ordinary ceiling or rosin varnish with the order to have it sent to the job marked "Liquid Filler," and some unscrupulous manufacturers are doing the same thing in seliing those improper finishing materials under the spurious name of "liquid filler" to the unsuspecting buyer. Advice is hereby given, if you do not buy your liquid filler from a responsible firm, you may prefer to mix such a filler yourself, which is easily done, thereby saving the price of the cans, manufacturing expenses and profit.

Formula for Liquid Filler.

Take a gallon of a medium good varnish, inside coach varnish preferred, and add to it from three to five pounds of a pure silex paste filler. Stir up or mix properly, and thin down with turpentine or benzine and you have as good a liquid filler as you can buy at any price. The quality of the filler will rest with the quality of the varnish used for it. The test of a good liquid filler is the same as previously given for paste

filler. Liquid filler should also be allowed to dry from twenty-four to forty-eight hours, according to weather conditions, and must be sandpapered before subsequent coatings are applied.

Liquid filler cannot, or should not, be used for any open pored or coarse grained wood, but its use is restricted to close-grained wood, but liquid filler can be used as an after coating over paste filler with good results, and in this case it is much preferable to a coat of cheap varnish, because it will stop suction to a better advantage and will prevent the sinking in of the succeeding coats of varnish.

Shellac.

It may be interesting to a good many mechanics to learn something about the origin of the materials they use, and the materials used by wood finishers are so especially interesting in regard to their origin and manufacture that the writer cannot help it, but give a short description about the production of some of them.

Shellac comes from the East Indies, being an exclusive product of that part of the world, and occurs as a sap, being sweated out from the branches of a small tree, appearing as small pearl-like drops of gum. The exudation of the gum is caused by the bite or cutting of

the bark of a tiny reddish-brown colored insect. The gum itself is of a clear, light yellow, transparent hue, but receives its peculiar orange color from the numerous insects sticking to it and connecting firmly with it. The gum itself is scraped off and collected, cleaned, picked and melted and spread in thin films on large stone platters. After drying the product, it is packed and shipped to all parts of the world to be used for various purposes of which the use for wood finishing consumes only a small percentage of the full output. The shells of the insect, cleaned from the tar, were formerly used for the production of a beautiful and lasting red color, used in wood finishing and painting, but owing to the expense of manufacturing, its use has been abandoned and modern chemistry has found good substitutes for it.

Shellac is soluble in either grain or wood alcohol of at least 90 degrees, and in most all distillations of wood, including the methyls, ethyls, acetones, fusel oil and some carbon products. For wood finishing purposes the alcohols are exclusively used as cutting or dissolving agents. The proportions used is about 3 to 6 pounds to the gallon of alcohol, and the solution is called shellac varnish.

Orange shellac varnishes are used on

the darker woods for first coating, or on oak and ash to produce the so-called golden oak effect, and on other light wood where a special light orange color is required. When a perfectly clear and transparent finish is required on light colored wood, the bleached or white shellac is used. Shellac is bleached in various ways: By filtering the light orange shellac varnish through spodium (refined animal charcoal), but the commercial method of bleaching is by cutting the shellac with a boiling solution of soda or borax, adding a solution of chloride of lime, precipitating the shellac with hydrochloric acid and washing the product to remove all traces of the chemicals, leaving a soft product of silky appearance which is dried and ground, after which it is cut with alcohol and made ready for use. The bleaching process being very complicated, is not recommended to be done by the wood finisher, who will find it more advantageous to buy the finished product. In fact, even the cutting of shellac is done by machinery, and the shellac varnish is sold ready for use to the consumer. Bleached shellac varnish will show a milky appearance when cut with alcohol, but it becomes perfectly transparent when applied to the wood. A refined bleached shellac appears as a perfectly clear liquid of a

light varnish color. Owing to its high price it is seldom used by the wood finisher, but is used extensively as metal lacquer.

Adulteration of Shellac.

Shellac, on account of its high price, is one of the most adulterated articles in the market, and rosin is its most common adulterant, but sandarac and other gums soluble in alcohol are frequently used. In some cases the adulteration of shellac serves as an improvement to it, as well as a cheapener. The addition of Venice turpentine, for instance, for shellac used for floor finishes, is actually an improvement, but the small amount used for that purpose can hardly be called an adulteration. Rosin, as an adulterant, can in no case be called an improvement. It will prevent the shellac from properly drying hard, cause it to soften under a higher temperature, and in many cases causes the after coatings to crack.

Testing of Shellac.

Aside from the chemical test for purity we are not in possession of any plain, practical test for shellac which could be used with advantage or surety by the practical finisher. A large export of rosin is made to the East Indies, and it has been found that this is

used in the adulteration of shellac before it reaches our shores and comes into the hands of the consumer. The bleached, bone dry white shellac is still more adulterated in numerous cases and in that state the adulteration is more difficult to detect. A test for the purity of shellac has been lately introduced in the market which consists of a testing solution that is poured into a tube containing a few drops of the alcohol solution, turning dark if adulteration be present. This testing solution is the invention of Dr. Langmuir, the chemist of a large New York shellac importing house, from whom it can be obtained, together with glass phials for making the tests and complete instructions for use.

Testing a shellac sold as grain alcohol shellac, for the presence of wood alcohol, is an impossibility for the finisher, because a deodorized wood alcohol or wood spirit can be used to quite an extent without fear of detection. In fact, there is hardly a pure grain alcohol shellac sold, the shellac so named being usually nothing else but mixtures with spirits as stated above. Wood alcohol has long been known to be an active poison, but recent investigations have proved it to be much more dangerous than was supposed. Several cases are on record

where painters using it have been made permanently blind by inhaling the fumes rising from it. Otherwise, wood alcohol has been proved just as good as grain alcohol, except on French polish work. Grain alcohol shellac will dry more quickly than wood alcohol, but with the advantage that grain alcohol shellac will take more time to "set," and therefore allows a better brushing out without showing "laps."

How to Use Shellac.

A glue set, first class bristle brush is the proper tool for applying the shellac, and either a double thick flat, oval, or round brush can be used, according to the work to be done. The surface must be properly smoothed and dusted. The shellac must be thinned down and that two thin coats are better than one heavy coat is the golden rule in this case. The thinning is done with alcohol, and should the alcohol be weakened from long standing or the shellac be thickened from the same cause, the addition of a small portion of spirits of turpentine to the alcohol is recommended to offset the action of the water in the alcohol.

The application is done by brushing quickly one way in long stretches, avoiding doubling up to prevent lapping and "no crossing allowed."

Touching up of spots missed must also be avoided, and the material must be properly and evenly spread, as shellac does not level as varnish does. Sandpapering or the use of steel wool between coats must be resorted to.

Objections to the Use of Shellac.

Good work, that is high class, must not be shellacked, but must be worked up with varnish from the priming coat on. The reason for this is that the shellac is alcoholic and does not connect with either the oily undercoatings or with the varnish used afterward, but will cause chipping off of the varnish on the least bit of rough use of the woodwork so treated. An example of and proof of this is a test on glass or metal, therefore shellac is only used on cheaper grade work, or where the finisher is forced to hurry up his work. No shellac should be used in any way on outside work, such as doors, vestibules, window frames nor in new buildings where dampness will cause the chipping off before long. The least amount of moisture on the surface will prove disastrous to shellac, or even prevent its application altogether, and the poor appearance of some work is quite often the result, especially on so-called spotted work.

Turpentine Shellac and Other Shellac Substitutes.

As with linseed oil, no proper substitute has been found for shellac, but in the last few years, owing to the high price, a good many attempts to make such have been made. One of them is the so-called turpentine shellac, which consists of quick drying gums and which is very good for certain purposes, such as stopping suction and where a non-cracking or chipping material is wanted. Other substitutes are made from spirit soluble gums in addition to rosin, and quite often the deadly and dangerous bi-sulphide of carbon is used by unscrupulous manufacturers, as a solvent for those gums. Those substitutes are without value for architectural work, and are only used in the finish of cheap furniture. Some of those substitutes may be mixed with shellac, after they have become aged and settled, but only to the detriment of the shellac.

Linseed Oil as a First Coater.

Some would-be finishers commit the crime of using linseed oil, pure or in connection with turpentine and driers, as a first coater. You may have noticed the dark and dirty-looking appearance of woodwork, especially piazza ceilings, wainscoting, etc., and may have at-

tributed it to the use of a poor varnish, but on investigating you will find, nine times out of ten, that it was a case of oiling the wood first before varnishing. Oil will remain soft, accumulate the dirt, prevent the varnish from properly drying, sink into the wood, carrying the varnish along, causing the latter to lose its luster and darkening the wood unnaturally until it becomes almost black. A test to prove this may be made by dropping some oil on a piece of wood and varnishing over it. Expose it to the action of the weather or atmosphere, light, etc., and you will notice how this spot will become gradually darker and be marked by a lusterless appearance. Should you find such would-be finishers who will proudly show you what a fine job they turned out and how cheap they did it, you may give them the advice to get their money back from their instructors; or, still better, to look for a different profession to make a living, as they are just the kind to bring discredit to our noble guild, but if you keep quiet and watch you will witness their commercial suicide and their removal to another place. Those fellows are of the "know it all" type and are easily distinguished. Generally they are unable to work for employing painters and start business for themselves, being too conceited even to

read The Painters Magazine, and learn something in that manner.

Varnishes as First Coaters.

Innumerable kinds and brands of varnishes are sold as first coaters under spurious and high-toned names and elaborate labels, but the majority are nothing but cheap rosin varnishes. The best material for first coaters are the so-called interior coach varnishes. If good, they will allow sandpapering within forty-eight hours, and can be properly worked before setting. It is preferable to use the first coaters as thin as possible and good brushing out is required. Furniture varnish of a better grade may also be used, but it is not advisable, except where cheapness is essential. On all first coaters not containing a pigment, steel wool can be used for smoothing down.

CHAPTER VIII.

Varnishing.

THE varnishing of hardwood is not, as some may think, an easy matter, to be taken lightly, but it requires experienced workmen to do it. The better grades of varnishes, the only kind to be used in finishing, are as a rule put up in original packages, ready for use, and should not be tampered with by the workman. Each different brand has its own nature, which must be studied before one can produce a good finish, and it is said that no two varnishes are alike because the varnish maker puts his soul into them. Some varnishes not only allow a thorough brushing and crossing, but they require it, while others, especially the quick-setting kind, must be put on in long, even strokes, something like enamelling, and must be allowed to level out by themselves.

Tools Used for Varnishing.

Brushes, pots, and all tools used in connection with varnishing must be kept in proper care and that cleanliness is next to godliness is here the golden rule. The proper tools are a clean pot, with cover, as a receptacle for the varnish in use. This pot contains a cross-

bar or wire on the upper part, for the purpose of wiping the superfluous varnish from the brush and to place the brush upon when not immediately in use. Another necessary appliance is a

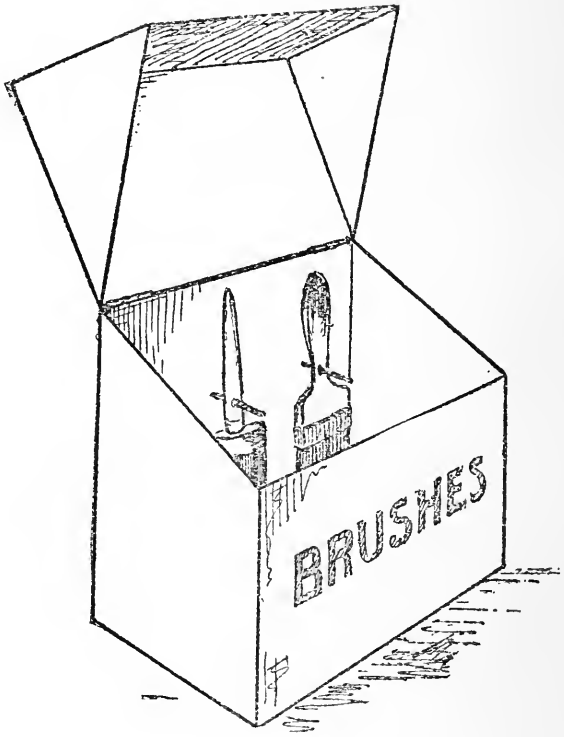

Figure 4.

square can with cover, as shown by the Figure 4, which is partly filled with spirits of turpentine to keep the brushes in, preventing them from hardening,

drying up, and getting dusty. The brushes are inserted deep enough to cover the bristles, and are hung upon the sides by means of a hook or by a wire laid across the top of the can, running through a hole in the handle of the brush. In no case should the brushes be placed so that their ends will touch the bottom of the can, but they must remain suspended and the turpentine must frequently be renewed and the can properly cleaned.

The style of brush used in varnishing varies according to the work to be done or to suit the fancy of the finisher. The proper brush is a 5-0 to 7-0 chiselled oval, made of elastic bristles, but a 2½ to 4-inch double thick, flat brush, glue set, is well adapted for some straight work. The quality of brushes to be used is governed by the rule that "the best is none to good," and some brush manufacturers take particular pride in providing the trade with as good a varnish brush as can possibly be made. Some would-be finishers have a tendency to save in the price of brushes, but willingly pay a fair price for the varnish, but by so doing they show their lack of experience. Another necessary tool for the finisher is a good bristle duster; not the kind which doubles up by hanging free on a rack.

Use of Varnishes.

In using varnish, it is recommended not to pour out of the original can any larger quantity than can be used up within one or two hours, and not to return to the original can any varnish which might be left in the pot, but such leavings may be put in a separate can and used up for priming work or added to liquid fillers. Varnish must not be thinned because the manufacturer produces the varnish in the proper consistency, but should varnish have become too heavy from long standing and require thinning, you may proceed as follows: Heat one large or two small vessels of water and place therein a can containing the varnish to be thinned and also a can containing sufficient spirits of turpentine for thinning. When both are properly warmed up, pour the necessary quantity of turpentine into the varnish and shake it up well, but be careful to do this away from any flame or open fire, as both materials, in the heated form, are very inflammable. After mixing, allow the varnish to settle for at least 24 hours, otherwise varnish should never be disturbed but carefully drawn off to avoid any sediment being mixed up with it. Even the best varnish, properly aged, is liable to settle or precipitate to some extent.

Varnish should not be applied in a temperature of less than 60 degrees F., the proper temperature being 70 to 80 degreesF. Bad wear, crackling, blistering, etc., might be the result of application in cold weather. At least the manufacturer will not entertain any complaint in such cases. Damp weather must also be avoided, as any moisture on the surface will certainly cause blistering, turning white or blooming of varnish. Of course, in new buildings, where the work has to be completed within a limited time, such conditions may often exist and neither the finisher nor the material can be blamed for the failure to produce the expected finish.

The surface to be varnished must be properly dusted and care must be taken to keep out dust as much as possible until the varnish has dried sufficiently to be immune to dust. Furthermore, the different varnishes should be applied according to their own nature and not to suit the fancy of the finisher, as all varnishes have their own peculiarities, no two varnishes being alike.

In applying, all deep laying parts of the work, such as panels, etc., are varnished first and the raised work, such as frames, stiles, moldings and the like, are done afterward. The work itself is started on the top or upper portions, the same as in painting. Base-

boards are done last. Forty-eight hours or more must be allowed for drying before applying the succeeding coat. A slight sandpapering or rubbing with steel wool, either one of a very fine grade, is required between coats, and gumming up of the varnish by sandpapering will prove that the varnish has not sufficiently dried to allow the next coat to be applied. Before the finishing coat is applied, rubbing with curled hair is required to avoid scratching. The finishing coat itself must be properly leveled or glazed; that is, after applying the varnish over a certain portion of the work and before it has had a chance to set, brush lightly over the work, using the tip or end of the brush without any pressure, to remove all brush marks and produce an even, glossy surface.

Testing of Varnish.

To test a varnish as to its purity, lasting qualities, etc., so as to give an immediate result in a practical way, is so far an impossible thing, and the reputation of the manufacturer must be used as a guide in buying. A good varnish must have a pure turpentine smell with a sweetish scent of the gum, the least trace of the smell of benzine or other obnoxious thinners will prove the impurity of the varnish. In filling a

long vial or test tube the varnish must appear clear, without any cloud; without consideration of the color itself as some of the most expensive, and especially the hard-drying varnishes, are quite dark in color. The best and severest test is done on glass. Take a clean piece of sheet glass, pour some of the varnish on it and watch it run. A good varnish will run out smoothly without showing "pully." It must level perfectly and set dustproof within a few hours, but should require two to three days to harden. The drying on glass will be considerably slower than on wood, but on metal, especially on iron, it will dry the quickest.

Varnish must not appear brittle by scratching, nor leave any white marks. Rubbing and polishing varnishes should not show any impression when pressed against with the palm of the hand. Any failure to stand these tests will prove the presence of rosin or other impurities. The best test of all, of course, is time.

All varnishes, good or bad in the course of time will crack. Naturally the cheaper grades will commence sooner than the better ones, and in the formation of the cracks a good or cheap varnish may be judged. The cracks of a common varnish will be large, wide and uneven, resembling alligator skin,

whereas the better grades of varnishes will show a crossed crack of a fine texture resembling spider web, forming straight lines which in a varnish of a fair grade should not be noticed within two to three years. Other immediate practical tests for varnishes, as above stated, are hardly known and it requires an expert finisher to tell by their action in working them if they are of better or inferior qualities. For bathrooms and exterior use varnishes are made to suit the purpose.

A little story may be given here as a guide for finishers in buying varnish. I happened to drop into the shop of a painting firm, located in a large town in the Eastern States. They were known in town as "the" painters and the head of the firm, considered "the master," was just relating some of his experiences when a dapper young varnish salesman entered, offering the products of the firm he represented. In his talk and arguments he showed that he lacked a knowledge of the fine points of the game to enable him to sell his goods to people who know something about them. After patiently listening to his explanations, the master painter told him that he was using the same kind of varnish for the last fifteen years, for which he pays a fair price, and the reason for not changing was that the var-

nish is still in a good condition on the job he used it on fifteen years previously, without being called upon to do the work over again, except an occasional rubbing over. "Well," said the salesman, "I do not see what gain you can have by this. Now I will sell you a varnish, much less expensive, which will wear well for five to six years, which no doubt would satisfy your customers, and at the same time you could have done the job three times over in that fifteen years, thereby gaining your profit three times instead of once." That, no doubt, seemed to be a good argument, but the master painter said, "you are quite right, young man, but still we are ahead of the game because we have done the job fifteen times over; that is, not exactly the same job, but we have had continuous work from those customers, ever since, without being asked for an estimate. At the same time we built up a reputation and neither our work nor the materials we use are ever questioned nor specified." To this the knight of the grip had no reply and departed without disposing of any of his goods.

CHAPTER IX.

Rubbing and Polishing.

IN most modern buildings rubbing or even polishing of all varnished work is required and specified, but is it always done as required? Or if it is done is it done properly? We hear about eggshell gloss finish, also about dead or flat finishes. What is the difference between them? An eggshell gloss finish is either called by the wrong name or the finish is done differently from what the name calls for. Have you ever seen an eggshell glossy? Take one and look at it. It shows an even surface not exactly a dead finish but nearly so; therefore the proper way to produce an eggshell finish would be to rub the varnish flat, which will leave a sufficiently glossy surface to resemble an eggshell finish. This can be done only with oil and pumice stone. Generally such finish is called a flat or dead finish, whereas in part such a finish should not show any glossy appearance whatever and with a flat or oil varnish this can hardly be produced. A spirit varnish would be a more proper material for this purpose.

Eggshell Gloss Finish.

When an eggshell finish is specified it simply means that the varnish

should be rubbed to produce a smooth, even surface, which is done as follows:

Procure some fine bolted, powdered pumice stone; place some of it in a shallow dish and mix up with water, using about five times as much water, in volume, as pumice stone. Furthermore, procure one or several pieces of rubbing felt which is sold in the better class of supply houses. Rubbing felt is from one-sixteenth to one-half inch in thickness and for straight work or large even surfaces the heavier kind is used, whereas the thinner sorts are used for broken work, such as mouldings, etc.

The felt is dipped into water and thoroughly soaked, after which some of the pumice stone is taken up with it. Now proceed by rubbing with a slight pressure, in long even strokes, over the surface taking care not to press too hard against the edges, to avoid rubbing off the varnish entirely therefrom, but at the same time keep well on the outlying portions of the work, because the center parts are always continuously touched, which process will secure an even working down of the surface. Occasionally the felt must be dipped into the water and some more pumice must be taken up with it. Take care not to allow it to get dry on the surface. Another good way is to en-

close the pumice stone in a coarse woven cloth, such as cheese cloth, and occasionally to knock this against the surface on the hand to remove from it the necessary quantity needed. This is, no doubt, a better method than the former and will keep any grit or hard substance from falling onto the surface, preventing scratching, which is liable to spoil the whole tedious job. To find out when the rubbing is to be discontinued, wipe over the surface with the palm of the hand and examine if any unevenness, such as air bubbles, pinholes, etc., are still visible. If found to be correctly smooth the work is done in this stage. The lower portions of the work, such as panels or other deep laying parts, must be rubbed first. Care must also be taken not to rub through the coatings of the varnish, as in this case such places will also show and cannot be removed except by applying another coat of varnish.

After being convinced of the thoroughness of your work, wash off the whitish appearing pumice repeatedly with clean water and a soft sponge until every trace of pumice is removed. Should any imperfect places be found they, of course, must be gone over in the same manner as above described.

To remove all traces of pumice or

discolorations caused by the water used, it is recommended to first wipe the surface thoroughly dry with a soft chamois skin, then rub over with a drop of oil or kerosene and follow it up with a good rubbing off of the oil with a woolen rag. This process will produce a nicely rubbed surface of a semi-glossy appearance which is so wrongly called an eggshell gloss finish.

Flat or Dead Finish.

To produce this finish the same way of rubbing as above described must be resorted to, with the exception that instead of water oil is used. The oil needed can be crude oil, paraffine, lem on or any specially prepared rubbing oils, which in most cases is nothing else but weak-bodied paraffine oil, scented with synthetic or other esesntial oils. The pumice stone is used in the same manner as for water rubbing. Water must not be used in any form. The cleaning off is done with kerosene, turpentine or other oils of a liquid nature which will not affect the varnish. A good method is to follow the work up by wiping off the last traces of oil and pumice with a weak solution of alcohol, taking about equal parts of water and alcohol. In all cases a thorough rubbing off with a soft woolen rag is needed before considering the work done.

Flat Finishes.

Of late years a good many flat finishes ready for use have been introduced to the trade to save the finisher the tedious work of rubbing by simply applying such preparations with the brush, but such processes are only followed on cheap work or by painters who want to get around the proper specifications with a view of benefiting their own pocket or to underbid other competing finishers who may probably have figured on the job according to specification, which of course is a very unscrupulous way of doing business.

None of those flat finishes produce a proper finish, because the unevenness of the surface will remain, as those finishes are used simply as a last coat and any sensible man can detect that class of work. Besides, none of those finishes will last as long as a rubbed surface, in fact a good many of them will show white on scratching and chip or blister off. Some of the better grades are made from a japan base or certain grades of gum in a similar way to other varnishes, but most of them are a mixture of wax and varnish. Not a few of the finishers are trying to prepare a flat finish themselves by simply dissolving wax in turpentine and adding the same to the varnish, mixing these materials by shaking, but this is a very primitive

way of doing and absolutely worthless. A fair material of this kind can be produced as follows:

How to Make a Flat Finish.

Take ¼ lb. of pure beeswax, cut into small slices or chips and pour over it about one quart of spirits of turpentine. Let this stand from twenty-four to forty-eight hours. After which put it in a water bath over a slow fire and let it dissolve. A water bath means a pot or vessel which contains water and into which the pot or can containing the wax and turpentine is placed to prevent the boiling over of the material and igniting. In the meantime place a can containing about one gallon of a good grade of quick drying rubbing varnish into another water bath, also heating the same slowly and carefully. When the wax is fully dissolved and both materials are fairly well heated pour both together and shake thoroughly. Let the mixture cool off and put it aside for at least from twenty-four to forty-eight hours to settle before using. Be careful not to use this preparation too heavy but have it quite thin, which can be regulated by the amount of turpentine used in dissolving the wax. This will give you as good a material as most of them are, but considering the danger of making it, including the time,

it is advisable to buy such a material when needed from any responsible firm which makes such an article a leader of their specialties.

Polishing Varnished Surfaces.

Polishing, as well as rubbing of architectural work, of course does not receive as usual care as work done on high grade furniture or pianos, but when polishing is required it needs an extra coat of a special polishing varnish which has to be provided by rubbing as before described. After rubbing your last coat of varnish with pumice stone and water, cleaning the surface thoroughly with a chamois skin and giving it sufficient time to allow all water or moisture to dry, you apply a so-called flowing coat of a good polishing varnish.

A flowing coat is applied in a somewhat similar manner to enameling; that is the varnish is not worked cross ways but applied in long, even strokes with a very soft brush and allowed to level out without running. At the very least, under favorable weather conditions four to five days must be allowed before you may start the polishing which is done in the following way:

Take finely powdered rotten stone and mix the same with either water or oil in the same way as using pumice

for rubbing. The applying of the rotten stone is also done in the same manner as the pumice stone, with the exception that for fine work the palm of the hand is used instead of the rubbing felt. The use of water is, in my opinion, preferable to oil, inasmuch as the remaining material is easier removed, which in architectural work is of great importance. The rubbing has to be continued until the desired gloss is obtained, after which the remaining rotten stone is carefully removed with water or oil respectively and the final use of diluted alcohol is necessary to prevent any foreign material from remaining on the surface. The use of a high grade alcohol is not advisable, whereas on furniture work it would be required. It will be found that rubbing or polishing with water instead of oil is more advantageous on varnish which has not had the full time to harden.

[Note.—Owing to its extremely poisonous character, and its liability to permanently affect the eyesight of the operator who inhales it or absorbs it through the skin, wood finishers are particularly cautioned against the use of wood alcohol for any purpose whatever.—Editor.]

CHAPTER X.

Wax Finishing.

A NUMBER of years ago, when black walnut and other dark woods were in style and extensively used, a waxed finish was frequently required in wood finishing; in fact, it was necessary in order to obtain certain effects, but of late years, owing to the exhaustion of the expensive dark woods, and as the light colored woods are more in vogue, a waxed finish is much less frequently demanded, nevertheless it is well for the painter or finisher to know what to use and how to do it. There are various ways of producing a waxed finish and to get the various effects desirable.

One Coat Finish.

A one coat finish is the simplest of all. The wood is smoothed down the same as for any other work, with probably a little more care, after which the one coat finish is applied rather freely with a brush suitable for the purpose; for ordinary work a 2½ or 3 inch flat brush will do. After the finish has had a chance to set or dry, which, in most cases, would require from 4 to 24 hours, the work is rubbed down with coarse rags, such as burlap, or still better, a piece of heavy Brussels carpet, but the most practical tool is a stiff hair

brush which is made especially for the purpose, or which can be substituted by a horse or military brush; one with leather backing and a strap across to hold it in place is the best. The rubbing must be continued until an even surface is produced; such work should be rubbed over occasionally to retain the brightness or dullness as it may be termed.

Materials Used.

The materials to be used are either the specialties sold in the market for this class of work or any of the so-called floor waxes, polishes or finishes which may be colored with any high grade dry color to suit the requirements, or if preferable the finisher may make his own material, for which the following formula is about the easiest way to follow:

Take a certain quantity of pure beeswax; cut it up in small chips and add to each ¼ pound of wax ¼ gallon of spirits of turpentine. Let this digest for from one to four days. Place the vessel in a larger vessel filled with water and heat slowly, continuously stirring, until all the wax is uniformly united with the turps, then take it from the fire and let it cool off, after which it is ready for use. To make a more glossy and harder finish, add to each quart of liquid about ¼ to ½ pint of a high grade copal varnish, while the material is still on the fire, or at least

right afterwards, before cooling off. For colored preparations the required colors may be added at the same time, or, if preferred, at any time after cooling. Should the material be too heavy the addition of turps, at any time, is of no harm. The proper consistency in ordinary summer temperature should be of a semi-paste or somewhat heavier than a good bodied varnish. Other more complicated formulas are useless for the finisher to lose time about and the products offered by reliable firms are generally the cheapest in the end, providing the absence of anilin or other easy fading and changeable coloring matters is guaranteed.

A one coat finish, although for some work just what is wanted, indicates nevertheless a cheap and, for most work, an insufficient finish. The one coat finish is simply the product of our hustling and quick living time; a natural product of the object to produce cheap work, done in a hurry, with the wrong idea that it can easily be changed if you tire of it or if unsatisfactory. A fact is, that a one coat finish cannot be changed into any other finish, but can only be renewed with the same material that it originally started with. The reason for this is the presence and rubbing into the wood of the wax and such other greasy material as may be contained in the various brands of those finishes. The removal of waxy and greasy

substances out of the pores of the wood is a practical impossibility or will be more expensive than the job will allow. Every finisher will agree that shellac, varnish, or kindred materials will never prove satisfactory if applied on such surfaces, therefore it is advised not to be too much in favor of one coat finishes.

Other Than One Coat Finishes.

The proper way of producing a wax finish is to build your work up the same way as for other finished work. All work which is to be stained should be stained before anything else is applied. See Chapter III. After staining, the wood may be treated with wax, if the wood is of the open pored or hardwood variety, and the natural condition of the wood is to be preserved, such as in antique finishes, but otherwise and if done on soft or close grained wood a coat of the best shellac is required before waxing. Sandpapering should not be done before but always after shellacking, to avoid specks, except in deep colored work a second coat of stain is used; furthermore a much finer surface is produced if sandpapering is done after shellacking. Shellac is recommended and preferable to varnish on all floor work for the reason that the best varnish is liable to soften under wax, and in cases where time is limited the improperly dried varnish will not al-

low the application and final rubbing of the wax.

Should it be desired not to have too much of a body on the wood a very thin coat of shellac should be applied, whereas otherwise two coats are preferable to a single heavy coat. Shellacking will allow the proper spreading and working out of the wax, and most important of all it will allow the entire cleaning off of the wax in case a change in the finish is desired, with the advantage of having an undercoating for the new finish, the cleaning in that case should be done with turps with a final washing off with alcotol to remove the last traces of wax.

CHAPTER XI.

Floor Finishing.

FLOORS are finished in various styles to suit the usage. The most ordinary and cheapest is oiling with a non-drying mineral oil. New floors treated in that way need a frequent renewal of the oil until the wood is thoroughly saturated with the oil and commences to show a finished surface when the oiling may be done less frequently. Care must be taken to remove all oil not absorbed by the wood with a woolen rag to prevent soiling of dresses.

Another way of finishing new floors is to sandpaper first, then give it a treatment of paste filler. After thorough drying one or two thin coats of shellac are to be applied, sandpaper between coats and a final rubbing off with a non-drying mineral oil or a wax treatment is required to prevent the wearing off of the shellac. Grain alcohol shellac of good quality should be the proper material. Varnishing of floors is a poor treatment, as the best varnish will easily wear off or soften under the oil and wax treatment and will show an unsightly watery gloss and in a short time a dirty appearance. Its refinishing is also more expensive and complicated

and its original expense is practically the same, besides having the disadvantage of the discontinuance of the use of the floor for about 48 hours, which, in inhabited buildings, would be an impossibility. Furthermore, the lasting qualities of varnished, against shellacked, floors, will be very noticeable. The preparation and use of shellacs have also been previously described under the same heading.

Waxing Floors.

There are various methods of waxing floors which all culminate in the same principal point and that is the final rubbing or polishing of the waxed surface. A very superior method is the working in or polishing of the wax with the well-known waxing brush, which ought to be found in every shop, but in rural districts where this work is infrequently done an improvised waxing apparatus may be of good service. Take any ordinary box or board of about six by ten inches in size; cover the lower part with a good piece of carpet, fasten a handle to the box and weight the same with any heavy article, such as flat irons, stones, bricks, etc. Apply your prepared wax as above described and after giving a certain time to dry commence polishing by pushing the brush or box systematically over the floor until the proper polish is obtained. A medium-sized floor of 200

to 250 square feet would require 3 to 4 hours' work, but it is generally considered finished after 30 minutes' polishing, which is entirely insufficient. This method should be repeated according to the wear and use of the floor, weekly or bi-weekly, which no doubt is expensive and troublesome, therefore an occasional application of a little oil properly rubbed off will answer in most cases and is preferred by the customers for its cheapness.

French Style.

The French way of finishing floors is, without regards to the kind of wood used, an application and polishing of wax without previous use of wood fillers, shellacs, varnishes, etc. For refinishing this kind of work the following process is used:

The floor is first thoroughly cleaned with turpentine and afterwards rubbed down with coarse steel shavings by footwork, which is done as follows: Take a good handful of steel shavings and place the same under the sole of your right foot after you have removed your shoes. Start in one corner and with a slight pressure move your foot forward and back, balancing yourself on the left foot, working systematically over the floor by taking strips across of about one and one-half to two feet, and after covering the floor start on the opposite corner, working your way the same way diagonally to the first move-

ment. Continue until the floor looks perfectly clean, using a little more pressure on uneven or dirty looking places. The after treatment is the regular wax treatment, as above described. No doubt the same style in cleaning can be used on shellacked or filled or varnished floors.

The most important point in floor finishing to remember is that the best and most expensive materials are none too good, therefore be careful not to underestimate your job.

CHAPTER XII.

Finishing of Fireproofed Wood.

THE finishing of fireproofed wood is one of the latest problems to be solved by the wood finishers. Most of the fireproofing materials or chemicals with which the wood is saturated to make it fireproof are secretly guarded and therein lies the difficulty in solving the problem—that is, to find an antidote which will prevent these chemicals from spoiling the finish. The bases of most fireproofing chemicals are salts and alkalies, such as the products of the sodas, borax, ammoniums, alums and lime. Some of those chemicals require different neutralizers than others and, not knowing with what the wood to be finished had been treated, it is certainly impossible to apply the proper remedy. Another difficulty lies in the fact that a neutralizer used may render the fireproofing material ineffective, change its action and undo the work, and possibly even increase its inflammability.

Result and Actions of Fireproof Materials.

All hardwoods containing tannic acid in the smallest degree undergo a

chemical action when subjected to fireproofing. The most noticeable is the discoloration caused by the process; also the swelling of the pores and fibers, rendering a proper Flemish oak and similar finish impossible. A fireproofed wood can never be finished in its natural color for this very reason.

If fireproofed wood has been properly dried out and afterward is kept dry, the effect on the finish may not be noticeable to any great extent, but it is almost impossible to keep it dry. Moist air or rainy weather will act on it and the most important reason is found in the fact that the wood absorbs considerable moisture from the walls of new buildings because the woodwork is placed in store in those new buildings long before it is needed, and finally the trim is put up right after the plastering is finished and in a good many cases before that. The trouble would not be so great in frame buildings, or other buildings of light construction; but there fireproofed wood is not required, and in so-called fireproof buildings the heavy foundation and solid walls and masonry in general require years before all moisture has escaped from it, if it ever does so. The writer had occasion to study the trouble closely in one of the largest buildings in New

York City, where he was called in to give his opinion how the difficulty could be remedied. In this particular case the woodwork, or at least the most part of it, was completely finished. All along the edges where the wood came in contact with the walls the varnish was discolored or softened, or in rooms where heat was used to force drying the varnish cracked and stripped off. A remedy in such a case is, of course, impossible except the varnish is entirely removed; at the very best, the finisher should never guarantee any work done on fireproofed wood, and especially not in cases of refinishing work, as above described, taking for granted that he uses the proper articles. For reasons stated in the beginning, he does not know which are the right ones; he may be able to make a passable job, but the trouble will surely show at the first opportunity All treatments tried up to date, without consideration of cost, have proved a failure in the case of finishing fireproofed wood, and especially such as used in building war and other vessels.

Remedies to Prevent Damages.

The invention of any material to successfully remedy the effect of fireproofing materials on finished woodwork would no doubt endear the inventor to

the hearts of the finisher and builder and besides bring him a substantial remuneration, providing he is able to secure a number of patents to prevent any possible change of formula by others, with the object of imitation.

The most favorable chemical which could be used for the purpose is acetic acid, which has the advantage of being entirely harmless to the workmen, non-inflammable and non-poisonous. But as it will act destructively on all kinds of metals and especially iron, it should be used before locks, hinges or other metal parts are fastened to the wood.

Next in order as neutralizers comes oxalic acid, which is very poisonous, but non-inflammable and not quite as harmful to metals as the former. To use oxalic acid or any other chemical for the purpose of bleaching out the discoloration caused by the fireproofing would be lost time and effort, because the wood will darken again in a short time and probably show a streaky or uneven appearance. Other neutralizers, such as ferrosulphide (copperas), hydrochloric (muriatic) acid, also nitric or sulphuric acids, are liable to cause more harm than they will do good, and therefore they should be left out of the question. Oxalic and acetic acid, properly dissolved in boiling water, are about as good neutralizers as

can be had for the purpose and still, in most cases, they cannot be used, while for other reasons they should not be used, and at the best are only of small importance. The mixture of those acids for use should be as follows: Take boiling water, dissolve as much oxalic acid as the water will take up; add to it about one-fourth in volume of acetic acid and an addition of a limited quantity of powdered alum may be made. This preparation should be applied to the woodwork in at least two applications, and after drying must be properly sponged off. In applying be sure to commence on the lower parts of the wood, working your way up to avoid streaks; the sandpapering of the woodwork should be done after a coat of shellac or varnish has been applied, except in cases where the wood is to be filled; then it is preferable to do the sandpapering first.

On all work done on fireproofed wood a coat of shellac, either before or after filling, is recommended, except in case where the highest grade of hard copal varnish is used as first and finish coat, and still shellac (grain alcohol) is preferable.

In cases where water glass (silicate of soda) is used for fireproofing an additional difficulty is caused by the fact that water glass is not entirely absorbed by the wood,but lays on the sur-

face, acting in fact as a first coater, but causing havoc to all finishes subsequently used. Careful consideration of circumstances and the use of common sense in doing the work will help to overcome some of the troubles in a slight degree, but to actually make a sure job of it is, at best, an imaginary proposition and therefore be careful not to guarantee any of this class of work, not even until it is supposed to be finished ready for inspection and delivery.

CHAPTER XIII.

Refinishing.

AFTER having thoroughly discussed all phases of finishing new work, it is not a small item to know something about refinishing old work, especially to those who have not had extensive experience in that line with the innumerable new articles manufactured for this purpose. First in the line of refinishing belongs

Touching Up.

Touching up old work is without a question an important item and has been very little discussed. A good job of touching up will save the finisher, at times, a good many dollars. Touching up of old work has generally been regarded as a job to be done by apprentice boys, whereas it requires not alone a fullfledged mechanic, able to handle the brush, but an artisan fully able to mix the right colors not only of the wood but also to imitate in color, the aged varnish so that after a finishing coat of varnish is applied to the touched up part of the wood, the spot will not be visible to an examining eye. If the varnish has chipped off and a touching up

is required, a thorough sandpapering is needed. After that take your stainers, put on your thinking cap and with a certain degree of knowledge, you should either match the color of the wood or make it considerably darker. Afterwards apply it to those places where it is needed, wipe off the surplus stain, so as just to leave enough color to give it an even looking appearance. Around door knobs, where the finish is generally darkened by dirt from handling, you may have to remove a certain space. The proper way of doing that is to run a mark on the top and bottom respectively, after which you have to remove carefully the old varnish between these marks.

Subsequently you apply the stain the same way as on the other places, and if by wiping off you should fail to produce the required effect, you may gain this by applying the stain with a brush, properly cutting in on the marks and evenly brushing out. In a good many cases an application of orange shellac will bring out the necessary color. Before applying the finishing coat it may be advisable to put on an extra cost of varnish, again carefully cutting in. Very satisfactory results may be obtained on all touching up jobs by the application of a so-called flat varnish or flat finish.

Refinishing Old Varnished Surfaces.

The process of refinishing old varnished surfaces has, in the last few years, been greatly changed on account of new materials, which have been invented and placed in the market for that purpose, and generally known under the name of "removers." Before discussing the use of these removers, it is very essential for the finisher to know their nature.

Alkali Removers.

The older of these removers were prepared, as an alkali base, such as compounds of soda, potash, lime, ammonia, etc., combined with other ingredients, either to reduce their strength, or prevent their after-effects on subsequent finishes. Although those removers have been generally regarded as paint removers, they also have found considerable use as varnish removers, before the introduction of the so-called neutral removers, which are of later origin. Alkali removers have the preference of most of the neutral removers on account of their non-inflammability and their non-poisonous character, but by reason of their careless use in the hands of incompetent workmen have proved to be very destructive to vegetable fibres. Furthermore, their chemical ac-

tion in darkening all woods, containing tannic acid, required a subsequent bleaching of those woods, and therefore such removers have become unpopular.

Neutral Removers.

By neutral removers we understand a material which is powerful enough to dissolve hardened oils and gums without injuring the wood and brushes. Still up-to-date those neutral removers are not perfect. The first experiments with neutral removers were made on the creosote and carbolic basis; although of disinfecting nature, their odor has barred them from all interior work. Their destructive action on the workman's hands has made their use impossible, but the main reason for their disappearance from the market was the fact that the destructive action of remaining traces of such remover in crevices, on subsequent finishes could not be stopped, because it is a well-known fact, that chemistry has failed to produce a neutralizer for creosote or carbolic acid.

After discarding the creosotes as solvents, experiments were made with products, derived from fusel oils. The most important of those is known as "amyl acetate," or on account of its odor generally known under the name of "banana liquid." This product was con-

sidered for a time the acme of removers. Its penetrating odor and its fatal influence on persons troubled with heart and pulmonary diseases, also its poisonous character has been instrumental in preventing it from becoming popular; another reason for giving up this material as a solvent agent was the scarcity of it in this country and the exorbitant price at which it was sold. The demand for neutral removers having become so great by that time that unlimited quantities had to be produced and the importation of "amyl acetate" from Europe was connected with unforeseen delays and high custom charges. Therefore amyl acetate removers have also become an article of the past.

Bi-Sulphide of Carbon.

The most dangerous material of anything ever offered to the trade under the guise of "Paint and Varnish Removers" was introduced by unscrupulous manufacturers with the object of gain. The cheapness, powerful solvent properties and apparent harmlessness were considered ideal points of value for the use of bi-sulphide of carbon in the manufacture of removers. The use of this material should have been prohibited by the authorities; nothing too strong can be said against its use and in the fol-

lowing will be given a few points as to the danger and the detection of its presence.

Bi-sulphide of carbon is known to chemistry as the most dangerous and treacherous poison and explosive. Its explosive power will be shown by its expansion in the proportion of 1 to 16. That means that one cubic foot of bi-sulphide of carbon will form 16 cubic feet of gas, which is a higher percentage than of any other gaseous liquid known. Another dangerous feature is its low flash point, which is below zero; that means that bi-sulphide of carbon will form gas below this low temperature and cause explosion if brought in contact with flame. For this reason bi-sulphide of carbon is sold under restriction in air-tight iron drums and is not allowed to enter large cities, except in limited quantities. It is easy to manufacture and can be produced at about 1½ cents per pound, while it is sold in the market in large quantities at from 4½ to 5 cents per pound. The solvent power of bi-sulphide of carbon is also of the highest degree, known to be of a strength of 5,000. That means that 1 part in volume or weight will dissolve in volume or weight 5,000 parts of animal matter or tissue. As an example, should you take the 1-5,000 part of the amount of blood in your body and in-

jected it into your veins, it will dissolve or decompose your entire system. This also would be the fact if the same amount of bi-sulphide of carbon is taken up in your system by inhalation. There have been and are to-day, materials in the market sold under the name of removers which contain up to 50 per cent. of bi-sulphide of carbon, labelled as harmless and without any "caution sign."

To detect bi-sulphide of carbon in removers is almost impossible by the layman or mechanic. The most common way of detection is the smell, which resembles the smell of black radishes. Another way of detecting it is by the weight, as bi-sulphide of carbon weighs from 12 to 14 pounds per gallon; any ordinary remover weighs from 7 to 8 pounds per gallon. It is recommended to reject all removers above that weight. Another test to find out the danger of any remover is by placing a small quantity of it in a receptacle and under ordinary temperature of from 60 to 80 degrees F., holding an open light about one inch above it. Should the suspected remover ignite under these circumstances it is advisable to reject it.

The effect of bi-sulphide of carbon on the human system is shown by dullness of the brain, loss of appetite, vomiting, tired and breaking down feeling, diffi-

cult breathing, darkening of the blood and a final decomposing or dissolution of the entire system.

Other Materials Used in the Manufacture of Removers.

Hydro-carbons, methyl and amyl acetates or spirits, which are under or over distillations of alcohols. Acetone, etc., are used in connection with benzin, naphtha, wood alcohol, waxes, etc., and in a good many cases bi-sulphide of carbon, to make up a commercial article. Continuous use of some of them have proven their harmlessness. No doubt the near future will bring us a material which will be generally used for this class of work, as it is shown by the immense use of the existing materials that removers have become a necessary article for the shop.

How to Use an Alkali Remover.

Alkali removers may be used on white wood, pine and all other light woods with satisfaction, except when shellac was used as a finishing material, because an alkali is a slow solvent for shellac, but on wood which has been previously painted and is to be finished natural, the use of an alkali remover is essential. Apply a coat of remover evenly to a surface of about two square

yards, repeat the application once or twice more, and after being sure that all old finish has been dissolved, remove all material, as much as possible, with a broad or putty knife, after which wash off with clean water and renew the water as often as needed until you are sure that all trace of the remover has gone. For application use a grass or fibre brush, and it is recommended to rub some vaseline over your hands to protect them. To render all remover powerless which may, through carelessness or for other reason have been left in crevices, moldings, etc., it is advisable to apply a neutralizer which in such cases where the wood has been darkened may be made to act as a bleacher. Before refinishing such work it is preferable to apply a coat of shellac previous to sandpapering, to produce a smooth surface. Under no circumstance must such remover be left on any longer than it requires to dissolve the old coatings.

Bleaching of Wood.

Bleaching of wood is done by applying solution of divers chemicals to the discolored surface, and the most commonly known agents or bleachers are as follows:

1. Vinegar, or acetic acid.

2. Oxalic acid, dissolved in hot water about one pound to the gallon, to which vinegar or acid may be added, applied hot, if needed.

3. Muriatic or hydrochloric acid, which is cut with zinc and diluted with water.

4. Nitric acid diluted with water and connected with No. 3.

5. Sulphuric acid, diluted with water, and if desired mixed with No. 3 or No. 4, or both of them.

For very obstinate cases a repeated application of the bleacher is required until remover is assured.

All bleachers must be thoroughly washed off from the surface after drying or treated with vinegar or diluted acetic acid.

Sufficient time must be allowed for drying before starting with the finishing coats.

Neutral removers are divided into two classes, the liquid and semi-paste removers, and each requires a different method of using. Liquid removers are simple in their use, but not as practical as the semi-paste. In using liquid removers all you need to do is to apply them on a small surface, and continue until the varnish is softened, after which clean off and use some of the remover on a rag or waste for a final

cleaning. But liquid removers will evaporate quickly and therefore must be applied more often than when we use semi-paste removers, and a smaller surface only can be covered at one time, therefore the use of liquid removers is more expensive.

Semi-Paste Removers

The proper consistency of a remover should be about that of a heavy varnish in ordinary temperature. All neutral removers will flow more freely in warm weather and thicken considerably in cold weather, owing to the waxy nature of their ingredients, but be cautious not to place a thickened remover near a heated stove or open fire for the purpose of thinning it, but in all cases take a pail with hot water and place the can in it for about 20 to 30 minutes, which will be a safer undertaking. Smoking or the burning of open lights while using neutral removers must be strictly prohibited, and also you must be sure to have sufficient change of air by keeping the windows and doors open to prevent gases from accumulating, thereby lessening the danger of explosion. On starting the work, divide the surface to be done into certain sections. On panel work take about two to three square yards at a time; on ordinary

work take about one door and frame or one window and frame. On floors take a strip about two feet across the room.

Use a soft brush for laying on the remover, and apply freely over the whole surface. After a few minutes time, apply a second coat, and if this should not be enough to soften the varnish, repeat it. Attention may be called to the fact that you cannot soften innumerable coatings of old varnish with a single application of remover. Another point is to give the remover sufficient time to do its work and do not try to clean off after the first coat, but let the remover remain long enough until everything is dissolved down to the bare surface before cleaning off. After three to four applications and about ten to twenty minutes time, should the remover fail to do its work, you may safely reject it as unfit and try some other brand. To clean off the softened material, take a broad knife or the regular scraping tool and deposit all the waste material in an old pail or can. The use of benzine or turpentine for cleaning off may, in most cases, be found inefficient. Alcohol will always be found the best and the cheapest, at least after using benzine or turpentine, you will have to use the alcohol for a final cleaning to remove all traces of

grease or fat, otherwise subsequent coatings are liable to scale or chip off on account of the greasy nature the wood will be in, which, with the use of benzine or turpentine cannot be remedied.

Should the wood previous to cleaning have been darkened by water, it will be found utterly impossible to apply any bleaching material unless alcohol is used for cleaning, and in some cases a washing with weak ammonia or soap powder, such as Pearline or Gold Dust, will be found necessary.

On all work where the use of bleacher is not required, the refinishing may be begun in any desired manner after a slight sandpapering or rubbing down with steel-wool. On such work, where a bleacher has been used, more care is to be taken. In the first place, the bleacher must be washed off, for which purpose weak vinegar is always preferable to anything else. After the wood has been allowed to dry, and before sandpapering, apply a very thin coat of shellac. This will give you a better and harder surface to do your sandpapering and a smooth job will be the result.

The use of wood filler on cleaned off surfaces may be omitted, as the pores of the wood are, as a rule, sufficiently clogged up to prevent the filler from

entering. Colored wood filler must not be used, especially not on surfaces which have been bleached, because the spongy nature of wood treated in that manner will make an uneven and spotted job. If it is required to give the wood a stained effect, a high grade stain, as previously described, will make a perfect job.

CHAPTER XIV.

Piano Finishing.

IN the following chapter we will try to give a general idea about piano finishing, but, of course, this class of work, being complicated and requiring great skill, cannot be mastered by simply reading about it, but its fine points must be acquired by strenuous and extensive experience.

First of all, the wood must be smoothed down as much as it possibly can be done; all abrasions or dents, scratches, etc., will show through the finish and mar the general appearance. Furthermore, the best materials money can buy must be used. Lastly, sufficient manual labor and common sense in doing the work is essential to produce the high-grade finish required.

To begin with, you will have to start by smoothing the surface with a flat steel scraper, such as cabinet makers use, or grind it down with pumice stone and water, for which purpose the imported manufactured brick pumice stone is preferable. Follow this up with fine sandpaper or steel wool.

If the wood is to be stained, do not use aniline stains, but a purely vegetable dye or chemical stain. Apply two

coats of stain, at the least, to prevent little white dots showing after sandpapering, as one coat of stains will not penetrate enough and will lack uniformity in color. After staining sandpaper again, but do not use steel wool, as it affects the chemicals used in the stains.

If the wood is not to be stained, or after it has been stained, fill the pores with a pure silex wood filler in paste form, either colored to match the stain or to suit the requirements of taste. Paste filler should always be used, without regard to the nature of the wood being closely grained or open pored.

After filling the wood allow at least forty-eight hours for proper drying, and use fine sandpaper again, taking care not to rub down the edges of the wood. Steel wool must not be used, as it will show black streaks caused by the crystal used in the filler. Should you be satisfied that you have produced a perfectly smooth surface, you may go ahead with the varnishing; if not, another coat of filler is required.

For varnishing use a first-class rubbing varnish. The same must be uniform in all respects, not too heavy and sufficiently aged. The varnish must be kept in the finishing room at least twenty-four hours before using to at-

tain the proper temperature, and must not be shaken when pouring out into the varnishing pot. Any varnish remaining after finishing work must not be poured back into the can, but can be used for any other class of work. Good varnish should never be thinned with turpentine, but must be used as the manufacturer produces it.

Brushes must be perfectly clean, and should be kept in turpentine, when not in use, to keep them soft. Before using the brushes rub them perfectly dry on a piece of board, but do not heat them over the edge, as you are liable to loosen the bristles, for which you may blame the brush maker. If a new brush is to be used, twirl it between your hands, holding it vertical, and dip it in turpentine before using, rubbing out the turpentine again. The best thing to do is to break a new brush in on some other work before using on a piano.

The varnishing room must be kept at a temperature of at least 70 deg. Fahrenheit, and must be dustproof.

Apply the first coat of rubbing varnish with a beveled oval brush, size about 6-0 or 7-0. Lay the varnish on evenly and brush in well. Let it dry for six or seven days, then sandpaper lightly with fine-grade paper and apply the second coat. Treat the same as

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the first coat and continue until you have from four to six coats applied, using always the same brush, the same varnish, the same length of time between coats and sandpaper each coat more lightly. Steel wool of a fine grade can be used for this purpose. Before revarnishing it must be observed that the varnish does not gum under the sandpaper, otherwise an extra day or two must be allowed for drying. After satisfying yourself that a sufficient quantity of varnish is applied, rub the last coat with pumice stone and water and a piece of rubbing felt, such as can be bought in the supply stores for this class of work. A fine powdered pumice stone must be used, and, to make sure that it is without grit, bolt it through a fine sieve made of cheesecloth. In rubbing, care must be taken of the edges, and also not to use too much pressure, in order to prevent rubbing through the varnish. All surfaces must be perfectly smooth, brush marks must disappear, and all uneven parts must be perfectly level. This work requires great skill and years of experience, which cannot be attained in a few trials, but must be a natural gift of judgment. After rubbing down, a thorough sponging off with clean water is needed, which should be followed up by a rubbing dry

with chamois skin. Should you find that, after cleaning off, the varnish has been partly rubbed through, another coat of varnish must be given, and once more it must be slightly and more carefully rubbed with pumice and water.

After assuring yourself of a perfect job, apply a leveling coat of the finest piano polishing varnish under the same conditions as above, using the varnish more freely, but avoid running. This is called a flowing coat. For this work use a triple thick, soft, flat hair brush, metal bound, about three inches wide. Seven days at least must be allowed for drying, and after that it has to be rubbed with powdered rotten stone and water, using the palm of your hand, which must be soft and adapted for the purpose. This rubbing must be continued until the desired polish is obtained, and, should this fail, another flowing coat of varnish must be given and rubbed again. After rubbing with rotten stone wash off perfectly clean and follow the rubbing with a few drops of rubbing oil placed on the palm of your hand. No proper piano polish can be obtained with less than six or seven coats of varnish. To take off the bloom of the varnish or the remaining oil you have to follow this up with a slight rubbing over with grain

alcohol used in a pad, which procedure will also bring out the luster more strikingly, but this is a very dangerous job. The slightest pressure or allowing the pad to remain an instant in one place, especially in turning the corners, is liable to undo the whole troublesome work, and may compel you to start all over again. To do this alcohol rubbing, continue as follows: Take a bunch of cotton wadding, soak it slightly in grain alcohol and cover quickly with an old, washed-out piece of very fine linen cloth. Take the pad so formed firmly between your fingers and thumb and skip over the surface as fast as possible without turning the corners until the alcohol is partly used up. This will produce the finest finish possible; but my advice is that if you are not experienced enough to undertake this kind of work, try yourself out at first on some ordinary work before taking chances of ruining a job so tedious and painful as the finishing of a piano.

CHAPTER XV.

Best Method of Using Water Stains.

THE following chapter was originally written as an answer to a question referred to The Painters Magazine by the Twenty-first Annual Convention of the International Association of Master House Painters and Decorators of the United States and Canada, held at Milwaukee, Wis., February 7 to 10, 1905:

"What is the best method of using water stains on oak, birch and other woods, and the best method of overcoming the raising of the grain?"

Before entering into the subject of methods for application, it seems appropriate that we should first go into the various methods of preparing water stains. Since the acid and alkali stains and water stains made from soluble anilines and other coal tar derivatives have found their way into commerce, wood finishers have found it convenient to make use of these for the sake of economy and convenience, but on account of their lack of permanence we would strongly recommend that house painters and decorators, in finishing interior woodwork, wherever water stains are admissible or convenient, to

adhere to the use of those made from vegetable matter by decoction or from lakes that are known to be permanent in color. Where a partial obscuring of the grain of the wood is not objected to, such materials or pigments as Van Dyke brown, burnt umber, burnt and raw sienna, rose pink, etc., may be employed, but these should be of impalpable fineness and of the richest tone possible. In order to make water stains penetrate into the wood as far as possible it is necessary to make the water alkaline or slightly acid, and while these additions tend to raise the grain of the wood more than would be done by ordinary water, there is a method to overcome or minimize this bad effect, as we will see later on. We are, in the following, giving one or more formulas for making water stains of known merit that will serve to imitate the color of the woods named, but, as a matter of course, it is for the operator to use them on such woods as are most similar in grain or such as have no prominent grain at all. For instance, it would be folly to stain yellow pine of a mahogany color and try to pass it off for the genuine article. On the other hand, cherry can be readily stained and given the effect of walnut by a stain made from Van Dyke brown and burnt umber.

Light Oak Stain. This may be made by dissolving one pound picric acid in one-half gallon of water, adding a mixture of one pound of soluble Van Dyke brown in three quarts of water, and when stirred together, one-half pint ammonia is added; the ammonia should be 18 deg. The stain should be applied as warm as possible with an ordinary whitewash brush or a swab of cotton, as it will injure the bristle brushes. The addition of one pint of turpentine to the above quantity of stain will prevent the raising of the grain.

Dark Oak Stain. One pound burnt umber is mixed with sufficient aqua ammonia of 16 deg. or 18 deg. to a stiff paste and then thinned with water to the required consistence. This done, it is strained through cheese cloth and before use it is heated until it begins to steam, when one-half pint of turpentine should be added to prevent the stain from raising the grain.

Another Dark Oak Stain is made by dissolving 12 ounces soluble Van Dyke brown in one gallon of water, adding one pint of aqua ammonia of 16 deg. to 18 deg. This should also be heated and have at least one-half pint turpentine added to prevent the raising of the grain.

Cherry Stain. One pound annatto boiled for thirty minutes in two gallons of water, to which one ounce of caustic soda or potash has been added, will produce a light cherry stain. If wanted darker, boil it until strong enough. To one-half gallon of the stain add one gill of aqua ammonia and one-half gill of turpentine. By boiling one-quarter Braxil wood chips with the above a deeper stain will result.

Another Cherry Stain is made by boiling in one gallon of water one-half pound of madder root and 2 ounces logwood chips, until the desired strength is attained. When using the stain add one-half pint aqua ammonia and one-quarter pint turpentine. Apply warm.

Mahogany Stain can be made in various ways. The following formula makes a rich and effective one. 4 ounces walnut, 2½ ounces crimson crystals, 2 ounces red, all of which are soluble aniline dye, 8 ounces aqua ammonia and 2 gallons water are slowly boiled until the crystals are dissolved and the liquor is strained. When about to use, warm the stain and add to every quart of it one gill turpentine.

Another Aniline Mahogany Stain is made by boiling 2 ounces Bismarck brown that is soluble in water in one

gallon of water, until the brown has dissolved. Let cool and strain it. For use, warm it and add to each half gallon one gill ammonia and one-half gill turpentine.

Still Another Mahogany Stain may be made from a mixture of rose pink, burnt sienna and a trifle of red lake, that are ground fine in water, the proportions varying as to the strength of the color. Four pounds burnt sienna, ¾ pound rose pink and ¼ pound alizarine red lake ground in water and thinned with stale beer or ale, will make a stain that will not perceptibly raise the grain of the wood.

Walnut Stain may be made by dissolving catechu that is bruised by boiling it in twice its bulk of water. To darken it, add an ounce of bichromate of potash to each quart of the liquid. Apply warm, adding to each gallon of stain one-half pint ammonia and one-quarter pint turpentine.

Another Walnut Stain is made by boiling one pound Van Dyke brown and one-half pound potash or concentrated lye in one gallon of water until reduced to one-half gallon liquid. While still hot, but away from the fire or water bath, stir in one-half pint of turpentine, and when cold apply with fiber brush or a piece of cloth.

A Light Stain to imitate **Walnut** or **Dark Oak** may be made by dissolving one-quarter pound permanganate of potash in one-half gallon of water, and while hot add one gill of turpentine to this quantity.

The Best Walnut Stain we know of, however, is made by dissolving in one gallon of water two pounds of soluble Van Dyke brown, by boiling and adding, while hot, one gill ammonia and one gill turpentine. This stain is best used while fairly warm, but may be applied cold also.

Rosewood Stain.. One quart of the last named walnut stain mixed with two or three quarts of mahogany stain will give a fair imitation of rosewood, or repeated coats of mahogany stain, penciled in with ebony stain in a skilled manner, will produce the erratic veining of rosewood.

Ebony Stain is produced from 6 ounces Nigrosen Black B, soluble, and 10 ounces soluble Van Dyke Brown, dissolved in one gallon boiling water, to which one gill of ammonia and one gill turpentine have been added. Apply fairly warm.

A Very Strong Ebony Stain is made by boiling on a slow fire for three hours 2 pounds logwood extract, green cop-

peras one-half pound, one-quarter pound nutgalls, 2 ounces Chinese blue, with one gallon of vinegar. May be applied either hot or cold. In this operation the grain of the wood will raise if the wood is of the soft variety.

For staining in the new fad effects any one of the soluble coal tar colors will answer, if dissolved in water, as directed by the color manufacturers, and many combinations can be made. Wherever alkali or even acid is present in the stains, it is best to add a small portion of turpentine, because this medium will prevent or overcome the raising of the grain. As, however, the slight emulsion effected between the turpentine and ammonia or potash is but very short-lived, it is necessary to stir the stain constantly during application.

It has been proposed, in order to overcome the raising of the grain of the wood, to make the water stains with strong glue size, one part glue to six parts water, but a trial will soon convince anyone that though the grain is not raised the stain does not penetrate and is more like paint, merely lying as a film on the surface, while in all staining on wood, in order to not obscure the natural beauty of the grain, that part of the stain which is not absorbed by the wood is to be

wiped off before the stain becomes set hard. And in water stains this is even more important than it is in oil stains, because the former are naturally more opaque on drying. It is hardly necessary to say that in staining woods with water stain, as well as in the case of oil stains, the surface, on drying, should be lightly sandpapered and thoroughly dusted before varnishing.

The following answer to the question is written by an expert hardwood finisher of many years' experience:

To prevent the raising of the wood fiber in the process of water staining is, and will be for some time, an impossibility, and if such a process were possible and the writer should be the lucky possessor of its secrets, he, no doubt, could dispose of it at a very high figure. Although having had considerable experience in hardwood finishing and being of an inventive disposition, having invented several seemingly impossible necessities in the painters and wood finishers' specialty line, I am not in a position to advance an idea to fully cope with the situation, but will try to give a few hints in that direction.

Any porous substance which absorbs moisture will expand in the process of taking up the moisture, except when this substance belongs to the mineral

world, but even among minerals there are some materials which have an expanding tendency, but there is hardly a vegetable or animal substance known which will resist the invasion of moisture without adding to its own volume. Sponges and kindred materials show this to the greatest extent, and wood is very similar to a solid grown sponge with a finer and harder texture. The ewelling up of the wood, by treating it with water, is more distinctive in the softer kinds of wood, and these woods show less stability and a shorter life, growing faster and dying out sooner than the harder species. Considering the age of poplar, birch, cherry, elm, spruce, pine, etc., against the harder and tougher specimens of the oaks, mahoganies, maples, etc., which require years and years to grow and of which we have specimens of hundreds and probably thousands of years of age. The texture of fiber of those latter kinds of wood is much finer and harder and more able to resist the action against moisture to a greater extent than the former. They show a greater tendency to petrify, and in that state are entirely indifferent to moisture. Therefore, if an effective remedy is to be created to prevent the raising of the fiber or the swelling up of the wood it must be done more on the

lines of petrifying, or at least of hardening, of the wood to be stained than by trying to find the remedy in the preparation of the stain itself.

There are, of course, methods and materials of staining wood almost as intense and as deeply penetrating as water stain, but those staining preparations are either not commonly enough used or they are considered too expensive or too dangerous to health or are so inflammable that their use is objectionable. To this class of staining materials or carriers belong the coal and pine tar products or distillations of numerous materials which are in the market in the form of turpentine, benzine, naphtha, benzoles toluols, dead oils, etc., but the question was raised about water stains, and therefore it is unnecessary to try to go into details about the others.

Now, if we could effectively prevent the moisture from affecting the wood fibers we would, at the same time, solve the problem of keeping paint and varnish on outside woodwork for an unlimited time, which would keep the painter and wood finisher out of work much longer than they are at present.

The only probable and visible practical process of using water stains with the least possible chance of affecting the wood is, until further develop-

ments, in the treatment of the wood itself and in the preparing of staining materials. In preparing the wood the finisher has to take into consideration the nature of the wood itself, as sappy or pitchy wood will stand a more severe and entirely different treatment than woods which contain acids and change their own natural color very readily, thereby also changing their natural appearance. Furthermore, the staining ingredients have to be considered and also the after finishing materials, as both are liable to be affected by the chemicals which may have to be used, either before staining or in the preparation of the stain. In chapters III. and IV. the reader will find various points in regard to stains and their preparation and uses, and there is little to be added, as the expert finisher is thrown back upon his own resources, because the work is so manifold that it is an impossibility for any one to describe any and all methods, since every finisher has his own individual ideas and generally keeps valuable points for himself, with the conceited satisfaction that he is smarter and more able to turn out a better job than his brother mechanic. Coming back to the question itself, it is a fact that fuming hardwood, with the aid of ammonia, does not raise the

fiber of the wood and produces a beautiful dark or antique effect. Of course this process cannot be used on pitchy or sappy woods or, in general, upon those kinds of wood which do not contain tannin or tannic acid. It also cannot be used on a standing finish which is already in position. The articles or chemicals most commonly used to prevent the raising of the fiber are alum and creosote or carbolic acid, of which the latter two are the most effective but the least practical. Alum can be used either by sponging or brushing the surface with a solution of about one pound to the gallon of water, before or after staining, or the powdered alum can be mixed with the stain, providing the stain does not contain ingredients which will not mix with the alum. This is about the best method known and will help considerably, but does not entirely prevent the trouble.

Creosote or carbolic acid may be used in the same way as alum, but they both are harmful to the hands and require great care in using. Their strong odor is objectionable, and they generally will leave after-effects on varnish used over them, because they are the only acids known to chemistry which cannot be killed or neutralized, that is, the action of the acid cannot be

stopped and will last for a considerable time, even in the diluted state they are used in. The addition of castor oil or glycerin to the stain is often resorted to, but these are not recommended, as they are non-drying. To use linseed oil would require a saponification process which can only be accomplished with the addition of alkalines, but this mixture will not penetrate sufficiently. Summing up the whole question, it must be admitted that up to now nothing is known which will remedy the trouble. Why not, therefore, use stain made with benzoles or other carbon products? A little experimenting on the part of both the finisher and the manufacturer will, no doubt, with the aid of chemistry, bring relief and perfection. If the members of the craft generally would be generous enough to give some points, known only to themselves, for the benefit of the trade, some real progress might be made along this line.

Index.

A

Acid and alkali stains..... 18
picric, for staining..... 19
sulphuric, for staining..... 19
Adulteration of shellac..... 44
Alcohol stains..... 16
Alkali and acid stains..... 18
removers 85
how to use..... 90
Alum 114
as a mordant for stains..... 18
for staining 19
American walnut..... 9
Ammonia, for staining.....19, 20, 24
Amyl acetate..... 86
Aniline stains.....16, 25
mahogany stain.....106
Antique effect for oak and other woods... 23
mahogany 33
oak 22, 23
oak filler..... 32
Ash 9
dark, with greenish cast..... 33
Hungarian 9

B

Bagging for rubbing paste filler..... 36
Bichromate of potassium for staining 19, 25, 26
Birch, straight and curly..... 9
Bird's eye maple..... 9
Bismarck brown..... 25
Bi-sulphide of carbon..... 87
Black metallic stain..... 27
Bleaching, care required..... 95
shellac 43
wood 91

Bloom of varnish, to remove.....101
Brazil wood..... 16
Bright mahogany..... 33
Brown stain..... 25
Brushes for varnishing..... 53
how to use..... 99
Brush keeper..... 52
Brushes to use for water stains..... 17

C

Campeachy wood..... 16
Canewood 16
Carbolic acid.....86, 114
Carbon bi-sulphide..... 87
effect on the system..... 89
Castor oil; to prevent raising fiber of wood 17
Catechu 23
Caustic soda for staining..... 19
Cherry 9
stain 106
Chromate of potassium for staining..... 19
Coal tar stains.....109
Coffee for staining..... 24
Colored wood fillers..... 32
Copperas for staining..... 19
green, as a mordant for stains..... 18
Cracking of varnish..... 57
Creosote 86, 114
Curly birch..... 9
walnut 9
Cypress 10

D

Dark golden oak, filler for..... 33
oak stain.....105
Dead finish 63
Dipping in stain..... 17
Driers for oil stains..... 22

E

Ebony, filler for..... 34
stain 108
Egg shell gloss finish..... 60
Excelsior for rubbing paste filler..... 36

F

Felt for rubbing..... 61
Fiber of wood; to prevent raising..... 16
Filler for antique mahogany..... 33
for antique oak..... 32
for dark golden oak..... 33
for ebony..... 34
for Flemish oak..... 33
for golden oak..... 32
for mahogany 33
for walnut..... 33
Fillers 28
colored 32
formula for liquid..... 40
liquid 39
paste, how to use..... 35
properties of..... 30
test for..... 28
Finish, wax..... 68
Finishing fireproofed wood..... 77
piano 97
Fireproofed wood, to finish..... 77
First coaters..... 39
linseed oil..... 48
varnishes 50
Flat finish.....63, 64
how to make..... 65
Flemish oak..... 20
filler for..... 33
Floor finishing..... 73
Floors, French style..... 75
Flowing coat..... 66
Forest green..... 33
French style floors..... 75
French walnut..... 9
Fuming 20, 113

G

Glycerin; to prevent raising fiber of wood 17
Golden oak 19
dark, filler for 33
filler for 32
Green, forest 33
stain 26
Ground glass for wood fillers 30

H

Hard woods 8
Hungarian ash 9

I

Iodine for staining 19

L

Lakes 16
Lake stains 26
Leveling coat 101
Light stain 108
oak stain 105
Lima wood 16
Lime for staining 19, 24
stains 24
Linseed oil as first coater 48
Liquid fillers 39
formula for 40
Liquid removers 92
Logwood 16
for staining 27

M

Mahogany 9
antique 33
bright 33
filler 33
stain 106, 107
white 9
Maple 9
bird's eye 9

Materials for one coat finishing..... 69
used in the manufacture of removers 90
Metallic black stain..... 27
Mordants 18
Muriatic acid as a bleacher..... 92

N

Neutral removers.....86, 92
Nitric acid as a bleacher..... 92
North Carolina pine..... 10

O

Oak 8
antique, filler..... 32
dark 8
dark golden, filler for..... 33
dark, with greenish cast..... 33
golden 19, 22, 24
filler for..... 32
Flemish 20
filler for..... 33
quartered 8
red 8
stain 105
white 8
XVI. century..... 24
Oil and varnish stains..... 20
Oil for rubbing..... 63
Oil, linseed, as first coater..... 48
Old varnished surfaces, to refinish..... 85
Old work, to touch up..... 83
One-coat finish..... 68
Orange shellac..... 42
Other materials used in the manufacture of removers..... 90
Other than one coat finishes..... 71
Oxalic acid as a bleacher..... 92

P

Paste filler for close grained wood..... 38
how to use..... 35
two coats..... 37
Pearl-ash for staining..... 19

Permanganate of potassium for staining.. 25
Piano finishing 97
Pick for cleaning corners..... 37
Picric acid for staining..... 19
Pine 10
white 10
yellow 10
Plane marks, to remove..... 11
Polishing 60
varnished surfaces..... 66
Poplar 10
Potash for staining..... 19
Potassium, chromate and bichromate, for staining 19, 26
permanganate for staining..... 25
Preparation of stains 23
Preparing the wood..... 11
Prima vera or white mahogany..... 9
Primers 39
Properties of fillers..... 30
Pumice stone 41, 61

R

Raising fiber of wood, to prevent.....16, 109
Redwood 9
Refinishing 83
old varnished surfaces..... 85
Remedies to prevent damage to finish by fireproofing material 79
Rosewood 10
filler for..... 33
stain 108
Rotten stone for polishing..... 67
Rubbing and polishing..... 60
Rubbing Felt..... 61
pumice for..... 14

S

Sandalwood 16
Sandpaper, to cut..... 12
Sandpapering 11, 12
Sandstone for rubbing..... 14

Sapan wood..... 16
Scraper 11
Scraping 11
Semi-paste varnish removers.....92, 93
Sharpening scraper..... 11
Shavings for rubbing paste filler..... 36
Shellac 41
adulteration 44
bleaching 43
grain alcohol vs. wood alcohol..... 45
how to use..... 46
objections to..... 47
orange 42
substitutes 48
testing 44
thinning 46
under wax..... 72
Silex 30
Soda for staining..... 19
Soft sandstone..... 14
Soft woods..... 8
Spirit stains..... 16
Stain, cherry.....106
ebony 108
green 26
light to imitate oak or walnut.....108
mahogany 106, 107
metallic black..... 27
oak 105
rich brown..... 25
rosewood 108
walnut 107, 108
Stains and staining..... 15
Stains, dipping..... 17
new fad effects.....109
oil and varnish..... 20
preparation of 23
reason for two coats..... 18
spirit or alcohol..... 16
varieties of..... 15
vegetable 16
water 15
best method for using.....103

Steel wool 12
to test quality of..... 13
Sulphuric acid as a bleacher..... 92
for staining..... 19
Sycamore 10

T

Temperature for applying varnish..... 55
of varnishing room..... 99
Test for wood fillers..... 28
Testing shellac..... 44
varnish 56
Thinning varnish..... 54
Tools used for varnishing..... 51
Touching up old work..... 83
Turpentine shellac..... 48

V

Varnish cracking..... 57
removers, alkali, how to use..... 90
liquid 92
materials used in the manufacture of..... 90
neutral 86
semi-paste 92, 93
with an alkali base..... 85
stains 20, 22, 27
temperature for applying..... 55
testing 56
to thin..... 54
Varnished surfaces, to polish..... 66
Varnishes as first coaters..... 50
use of..... 54
Varnishing 51
a piano..... 98
floors 73
Venice turpentine in shellac..... 44
Vinegar 91
for staining..... 19

W

Walnut 9
American 9
filler for 33
French 9
peels for staining..... 24
South Russian or curly..... 9
stain 107, 108
to imitate 27
Water stains 15
best method for using.....103
kind of brushes to use..... 17
mixed with anilines..... 16
Water rubbing..... 63
Wax finishes..... 71
finishing 68
in flat finishes.....64, 65
Waxing floors..... 74
White mahogany..... 9
pine 10
debarred from water or alcohol staining..... 17
Whitewood 10
debarred from water or alcohol stains 17
Wood alcohol, poisonous.....45, 67
Wood bleaching..... 91
Wood fillers..... 28
colored 32
properties of..... 30
test for..... 28
Wood, preparing..... 11
Woods, hard..... 8
soft 8
used 8

X

XVI. century oak..... 24

Y

Yellow pine..... 10

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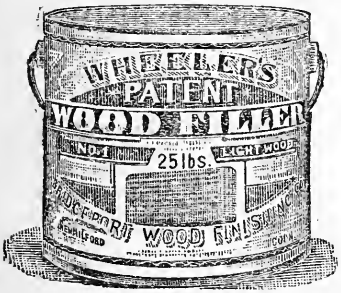

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